Research Article

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Learning, Memory, and Metacognition

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Abstract

The significant intend of this study is to explain the effectiveness of metacognition to learn as a mental procedure and pragmatical process. Hence, metacognition is an internal procedure which can constantly afford learners some effective strategies to monitor, scrutiny, and regulate their learning inputs and outputs accordingly to internal and external stimuli. In fact, this article is a theoretical overview about learning, memory, and metacognition. Learning is a complex and internal process in result of interactions and experiences which can be gradually observed as permanent changes in individual behaviors. Furthermore, metacognition lets learners to make logical and useful decisions during accomplishing learning tasks to solve and figure out their problems. This research contents also approve that how can individuals apply metacognitive strategies to learn more conveniently than other learners that are deprived from them. So, the prominent goal of this study is to indicate and predict that how can metacognitive strategies help individuals to pilot their learning process parallel and beyond cognitive strategy to achieve their learning requirements.

Keywords: Learning Strategy, Memory, Metacognition, Metacognitive Strategy, Scaffolding, Schema, Stimuli.

Introduction

Learning is a term which can be present in diversity of definitions such as the immanent changes in learners' behavior as result of experience and perseverance. It may also mean knowledge acquiring via study, gain knowledge or skill through study, teaching, education, or experiment, and to gain knowledge as a process. To learn is a process which learners' behavior will change, shape or control. In addition, it is a unique process to construct pragmatically plumbing; based on experience from a wide range of sources. Hence, some physical or psychological factors and obstacles can effectively prohibit or facilitate learning process like cognition strategy, metacognition strategy, internal and external stimuli (singular stimulus), schema (plural schemata) learning conditions and atmosphere, learners' attitudes toward learning process, emotional intelligence, intuition about learning contents, teachers' experiences, etc. Learning history tracked baked from ancient Greece, but the new history of learning psychology dates back to recent century(21st). William James is an American philosopher and physician that considered to have been in at the very serious study of a mental process. He said in 1890, that psychology was the science of mental life. Learning is not exclusively restricted to education domine and system. So, it begins a very long time before school, and it may develop after school. In addition, it will rapidly progress in aspect of different strategy equally with education. Metacognition is a mental faculty of human which can help learners to learn more conveniently. It leads to learners to regulate their thinking of knowledge. To observe consciously our thinking process is a reflective process. Several questions might be asked during reflective process such as: What problems are to be figure out? What should I do? How am I doing? How do I do well? What can I do differently and better than next time? To teach learners to apply more metacognition strategy equips them with skill to pilot consciously their brain and they will be self-monitored learners. Likewise, in metacognition learning style, learners need explicit instructions on how to screen their mind to adjust their thinking velocity; speed down or speed up whenever they demand. One of the most fundamental mental process is memory. Our brain is an organ that is responsible for what we call mind. Brain function is to pore, imagine, fell, desire, noticing, acquisition and memory, curiosity, and behavior. Without memory learning process is not possible except simple reflexes and ordinary actions. In other words, metacognition is a systematic duty of our memory that led individuals to learn more efficiently. Memory has been defined as "behavioral change caused by experience, but learning is a process to acquire memory." Metacognition can tremendously increase brain functions to learn new knowledge. It can conspicuously boost learning process and to support individuals to learn more effectively. Therefore, awareness and monitoring learning process are metacognitive strategies. If learners' metacognition skills perfectly form and develop, they can perform and practice beyond time and space. So, to support metacognition development is an effective strategy for promoting learners' success in schools. Learning, memory, and metacognition are closely linked together and are very related terms and concepts. To acquire gradually new knowledges and skills is learning, the expression of what have been instantly learnt is memory, but metacognition is thinking and controlling internally the learning process and procedure in learners' minds. Metacognition not only boosts long-term retention, but also bridges the gap between familiarity with a topic and deep understanding of it (Adesope et al., 2017; Smith et al., 2013). Students with strong metacognitive skills are positions to learn more and perform better than peers who are still developing their metacognition (e.g., Wang et al., 1990). Metacognition was described (Flavell, 1979), enthusiasm for its potential impact on student learning has remained high. We define metacognition as awareness and

control of thinking for learning (Cross and Paris, 1988). Metacognition is a term that has been used so broadly that its meaning may not be clear (Veenman et al., 2006). Indeed, metacognition succor practically learners to be more self-care and self-conscious about their performances during acquiring the competencies and it will also help them to be more filed independent learners. Metacognition strategy also assists learners to be more critical thinkers about their learning process and how must they appositely use previous knowledges and experiences(schemata) to develop their learning capacity across cognitive strategy.

1. Learning and Memory

Memory significantly will impact leaning process. It has been defined as human mental faculty to process cognitively and intellectual activity which plays vital role for learning process. Memory process includes three prominent terms; encoding, storing, retain and recall information to facilitate and propel

learning process. So systematic or unspontaneous forgetting can be destructive or may postpone or prohibit learning process. To organize memory will help learners to manage their brain function to learn more conveniently. During encoding stage, the information change to a new aspect and mode by where it will ready to transfer or use. It is a mechanical procedure which is not bound to or belong to human brain. Encoding can be used for programming in computer systems while information processing and other technologies which are engaging to information processing and data saving. If the information cannot encode, it cannot correctly retrieve or remember. In human memory approximately most of information unconsciously catch, but a little information saves consciously while we are using metacognitive practices for keeping information. During recalling information in memory, the information which have been unconsciously stored retrieve back toward our conscious mind.
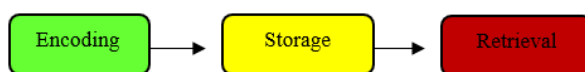

Figure 1.1 Memory frame and information processing in brain

Richard Atkinson and Richard Shiffrin (1968) have considered three different types for human memory as sensory memory, working or short-term memory, and long-term memory. Following figure indicates information process and procedures also the memory types.
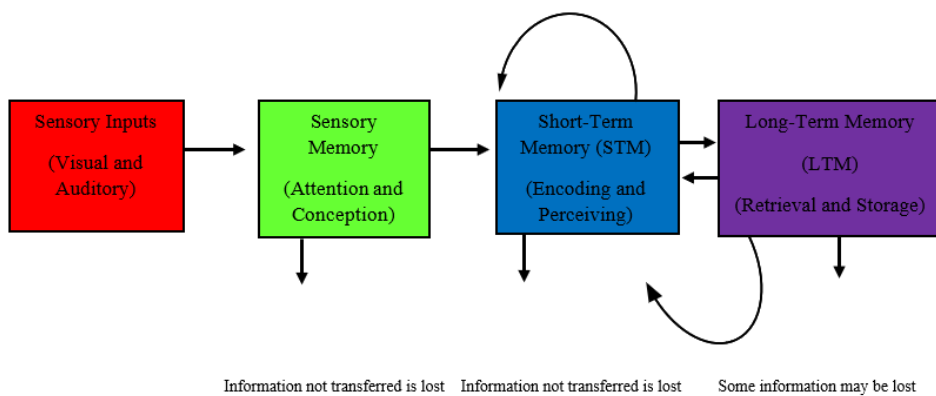

Figure 1.2 Memory models and information perceiving, processing, and learning

1.1 Sensory memory

The earliest stage of information processing is sensory memory. Some information can be store for a lapse or temporarily in memory so they will disappear and forget very quickly. In sensory memory just some restraint information and data can be saved such as visual, auditory, and the tactile while we see, hear, or we touch somethings from our surrounding environment. The stored information if do not transfer to short-term memory they will be forget partially or completely.

1.2 Working memory

The second stage of information processing in memory is working memory. Working memory links to short-term memory (STM) and in fact they work correspondently but perform different functions for information processing. Short-term memory only stores information a little more than sensory memory, but the working memory besides of storing information it works upon information to transfer into long-term memory (LTM). Some psychologists believe that short-term memory and working memory are different, but others do not consider them separately. Indeed, working memory manipulates information in brain to convey forward the long-term memory

or to currently use. The prominent function of working memory is executing information to transfer toward long-term memory.

1.3 Short-term memory

Short term memory is an essential part of our brain in which information can be stored for a short time averagely for 20–30 seconds. Short-term memory caters human retention of some amount of limited information that includes auditory, spatial, and visual stimuli. It plays cognitive roles to hold information which exists in sensory memory no longer. On other hand, focal attention can regulate information processing of sensory inputs while encoding stage. In fact, short-term memory is an essential part of brain which can help to store and process some information in memory.

1.4 Long-term memory

Long term memory is a part of brain which information can be hold for a long period of time such as several days, weeks, months, years, or decades but provided that the brain stays healthy and encoding information systematically works well. Long-term memory can be called preconscious or unconscious memory. The stored information in long term memory have been cached from outside environment or external inputs.

1.5 Losing Mind

One of ordinary and natural events during information processing for daily activities, is a phenomenon that called to forget some or whole of stored information in memory or losing memory contents. Diversity of reasons and barriers can be effective to loss information as to fail during storing new information, interfering new data with the old information, to fail while the retrieving information, and the most important factor is motivation and inclining toward forgetting spontaneous or consciously, and unspontaneous or unconsciously.

1.6 Memory and learning process

The foundation of learning process and procedures is memory. Memory role is crucially vital for learning process and for individuals that are interacting with outside environments and inputs. Without memory learning is impossible process and neutral procedure. So, memory will help individuals to learn more systematically and fundamentally. According with new neuropsychological research findings in our memory are some regions and lobs which engage to information processing link with learning process to perform special functions as catching information, recalling, etc. Hence, an optimum learning process related to have a well-organized memory system. When memory can perform cognitively all the functions, individuals will learn without flaw, error and sufficiently. If new knowledge and skills be inappropriate or different from previous knowledge and experiences in learners minds, they will encounter to struggle and difficulty to save and link new information to old knowledge and skills, and for information processing stage. In addition, the challenges and difficulties during learning and information processing cognitively connected to interdependency of learning process and memory and to procedure information in

memory. Learning and memory are two complementary functions from individuals' mind. Learning involves to acquire new knowledges and skills. In other side of coin; memory is ability of brain to store information for processing and recalling in the future times. During learning process individual memory should cognitively works well to perform its functions. To enhance learning process and memory capacity to achieve more success; several strategy and suggestions are available such as sufficient rest and sleeping, systematic reading practice, to exercise and drill, and music therapy. So, learning is a simple but complicated process and procedure of human brain and memory which refers to achieve new knowledge and skills by experience through human life. When the information in brain develops; individuals will learn new knowledge and skills. In memory and brain changing and developing neurons is in result of developing information and acquiring new knowledge and skills or message encoding. Through learning process, inside our memory and brain will develop which allows us to get and store new knowledge and skills more conveniently and effectively. However, learning is the dynamic aspect of individuals' memory process and activities that can involve a diversity of interactions in behaviour. Learning process can be performed implicitly or explicitly. Implicit learning refers to acquiring knowledge and skills unconsciously or without awareness and arbitrary activities. On other hand, explicit strategy is to learn new knowledges and experience spontaneously and intently or consciously. Indeed, explicit learning depends to do and perform practice and drill or to follow the instruction of learning process. For instance, while a child or kid generally learn to speak, listen, or mimic caregivers or implicitly. But when an adult learns through study and practice or explicitly.
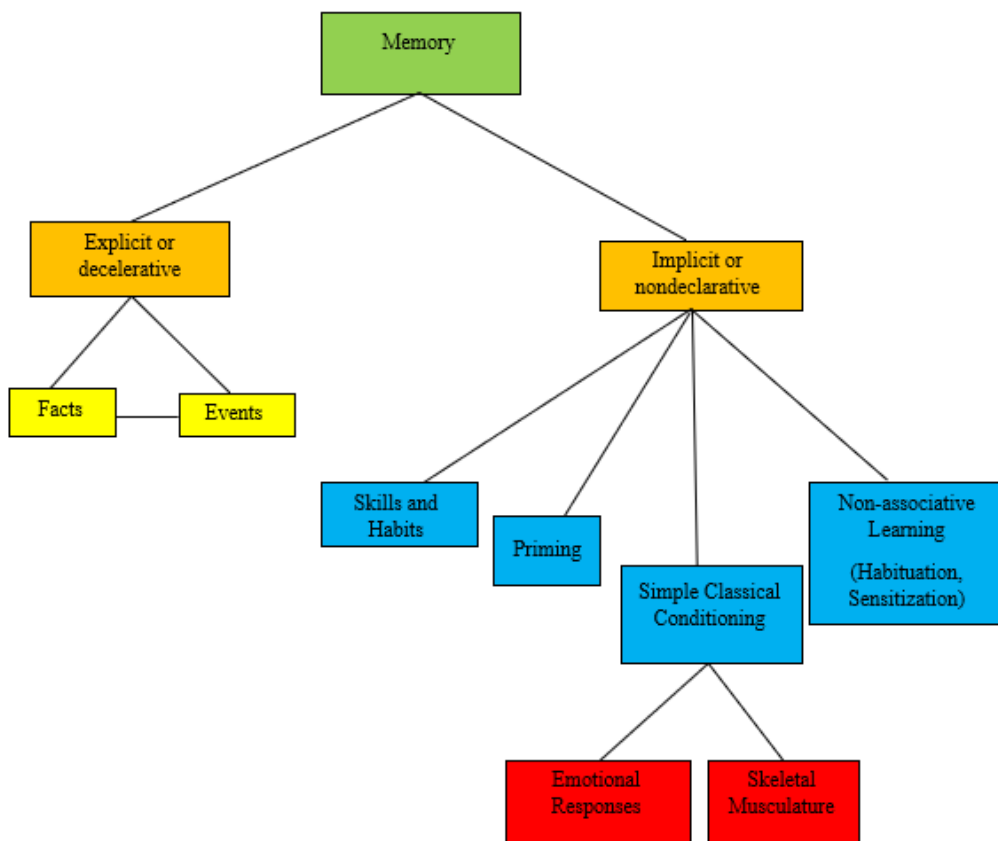

Figure 1.3 Explicit and Implicit Memory (Squire and Knowlton, 1994).

1.7 Perception, Memory, and Learning

Perception is a term that can play a critical role for learning process and memory while to get new information to store and process in mind. Perception is cognitive process and procedure in memory which its sources are from external stimuli or inputs of individual outside environment. A systematic perception usually leads to permanent learning about things information. On other hand, perception is always for decision making. Memory and learning mainly depend to perceiving new inputs. and perception is cognitive aspect of brain. It always restores and reconstructs into individual memory and it is the primary need for learning process. Indeed, without perceiving things information processing and learning is impossible; that means the information must be perceive before anything next information processing and then it leads to immanent and perpetual learning. It is a notion which refers to piloting and recognizing new knowledge and skills for remembering and recalling, and learning. Furthermore, learners while percept accessible information or inputs they will store in their memory.

Memory is an essential part of brain for information processing and learning. Perceiving information and processing must actively pass diversity of stages such as to store, retrieve and recall input and information. Many years ago, approximately nobody did not probe and know a lot about memory premises, but today by doing diversity scientific researches about brain and memory it is not a bizarre matter of fact for us. Human memory is like a computer system but they are different according some latent and patent aspects. Without to have a healthy memory to moderate information processing and learning is impossible. Memory and learning can be occurred explicitly or consciously by practice or following special instructions and schedules. On other hand, learning may occur implicitly or unconsciously without doing no exercise or following any instruction. Consequently, memory is obviously an alienable part of our brain which its real nature is resilient and it can help to hold and process a limitless and a great amount of information and it can effectively impact on our learning process positively or negatively. It can also assist learners to prolong and perform their learning activities.

2. Metacognition and Learning

Metacognition is the strategy to support positively learning process and to develop learners' capacity to acquire new knowledge and skill easily. However, when individuals are more obliging about self-care for learning process; they will learn more effectively than while they are not conscious about their learning process. To choose impactive strategy such as metacognition can help instructors to notice their individuals to control, pilot, and internally purvey themselves for learning environment and to learn new knowledges and kills. So, to use metacognition strategy will enhance teaching and learning process and teaching/learning activities will be more active

tasks. Hence to measure metacognition positive effects is not always observable and perfectly possible for researchers. To develop learners' metacognition knowledge; will help them to estimate, find, and notice their strongness and weakness in learning process. Also, individuals can profoundly pore about their learning process and memory procedures. To solve and vanquish on learning obstacles and lacks is too important for instructors and learners during an educational course. Metacognition and learning new skills and information are closely linked together. According to a lot of research findings we can understand that metacognition will increase learners' learning ability. Metacognition enables individuals to monitor and correct their false opinions about learning process and they will figure out their ways of standard learning conditions. Moreover, metacognition can be use in all aspect of learning process for life-long learning. Today the major intents of instructors, is to facilitate cognitively learning process for individuals to help them to construct their cognitive memory for learning more conveniently than other leaners. However, metacognition essentially helps learners to promote their cognitive capability for learning more effectively. Metacognition is the ability of mind that is the strategy of learning how to learn to develop individuals' expertise for learning new knowledge and skills. Furthermore, learning how to learn in an effective strategy in education domain since 1970s. Recently learning how to learn instructions is determined for fostering learners about some effective strategies such as summarizing, note taking, and reading comprehension practices, monitoring and screening learners to evaluate and adjunct their learning practices for enabling them to achieve progress in education courses and reflecting about their learning activities. Teaching students learning how to learn has been globally accepted by instructors but some impedimenta are meaningful as "some concepts are mentioned as certain domains such as metacognition, personal background knowledge about learning of learning process and individuals' expertise. When learners focus to how are they learning; they will different from what are they learning. So, they can control consciously their learning process. Learning process, the emphasis is for metacognition strategy that has been generally regarded as to speculate about cognitive process that intercalates metacognition knowledge and the executive aspect of learning process. (Brown et al., 1987) these two concepts refer to knowing how to learn effectively and efficiently. Indeed, metacognition has been considered as a systematic process of learning that asserts students besides of attention to what are they learning or the general inputs about their learning process they also must be able to perform and practice the knowledge and skills or they must be enable to link, perform, and develop previous knowledge and experiences to new skills. Following figure indicated the relationship between metacognition and learning process.

Figure 2.1 Metacognition strategy and learning

2.1 Metacognition

A lot of definition and terms in regard of metacognition and learning process exists as metacognition is the general knowledge. It is mental caliber of individuals mind that empower them to plan, monitor, evaluate, foster, and change their behaviour effectively to learn better than before. It often describes as a mental task to get new knowledge and skills also for regulating them. First task refers to learners' knowledge about their learning process or their cognitive activities of their brains. Metacognition about knowledge can include individuals' talent about a particular skill. Furthermore, it may contain the different and accessible strategies about learners' knowledge while they prefer to use appropriately to approach their learning goals. But the second aspect or dimension of metacognition can apply for regulating knowledge and skills. Regulation knowledge enables individuals to pilot, and check cognitively their learning process. For instance, a learner may realize during learning process that one strategy is not impactive for his/her learning so he/she will change his or her learning strategy to other effective strategies. Metacognition usually involves the phases as the following figure.
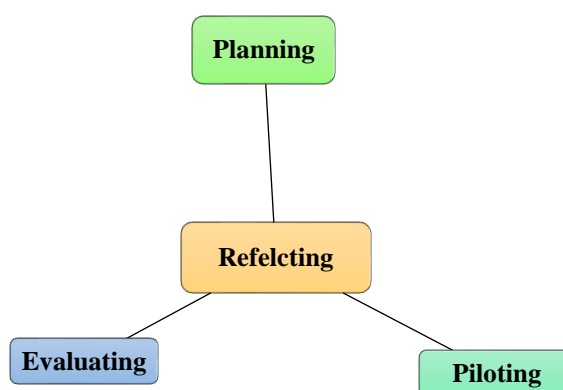

Figure 2.2 Metacognition Phases

2.1.1 planning

The first phase of metacognition strategy is planning or organizing in which in this stage individuals deliberate their learning aims that their teacher has catered and determined learners should achieve the task and which effective strategies they must use. During planning stage following helpful questions are important for learners.

'To do; what we are being asked?'

'Which effective learning strategy can we use?'

'Is there any effective strategy that we have probably used previously?'

2.1.2 Piloting

The second stage is piloting learning process that learners should complete and steer their mental schemes and scope internally their progress that they are performing and dealing through their learning purposes and circumstances. During monitoring or piloting stage individuals can convert or compute some available strategies which are not useful according with

their learning goals. While learners are performing their learning practices to ask themselves following questions can help them to learn more conveniently.

'Are useful the strategy am I using?'

'I require whether to struggle some activity different or not?'

2.1.3 Evaluating

While to evaluate learning process; the usefulness degree of learning strategy which they had used and it succor them to approach and prognosticate their learning aims. As students study, it is critical that they monitor both their use of learning strategies and their understanding of concepts. Yet many students struggle to accurately monitor their own understanding[1]. Prodigy and genius students also tend to use their feelings of confidence or preparedness to evaluate their plans, but these feelings are subject to distortion[2]. To ameliorate this phase individuals can consider following questions.

'How did we effectually perform?'

'What skills cannot progress well and why?' 'Or what can we perform differently for future?'

'What have been effectively done?'

'For what vague type of problems would we apply that strategy?'

2.1.4 Reflecting

To reflect learning process is an essential part for planning, piloting, and evaluating new knowledge and skills. Trigger individuals to ask themselves some effective questions about learning process is a dimension of reflecting strategy which can propound and support them to learn more effectively. Indeed, reflection is the most important part of metacognition practice in class environment.

Schraw and **Moshman** (1995) modified a framework for metacognition that generally used in biology education. The following figure is a theoretical framework which divides metacognition into two distinct components.
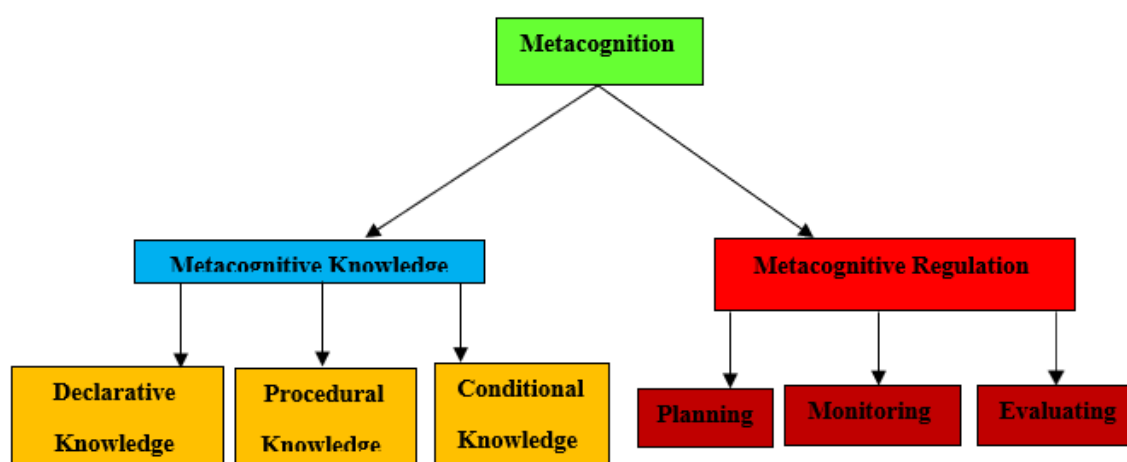

Figure 2.3 Metacognitive Frameworks (**Schraw** and **Moshman**, 1995).

According to the above theoretical and supplemental figure, metacognition has been divided into two prominent components: metacognition for knowledge and skills, and to moderate or modulate metacognition procedures. During metacognition of knowledge or skills; it intercalates to know how to learn or speculate about learning process and strategy. But declarative knowledge refers to accepting ourselves consciously as a learner of learning tasks' requirement, and what strategy can more efficiently help me to learn new knowledge and skills. The procedural knowledge is the knowledge about learning strategy. To know how, when, and why to use an effective strategy for learning process is the conditional knowledge or learning according with condition or adoptive learning. Indeed, metacognition is a form of dynamic learning and productive activity to develop individuals' learning strategy, to promote learning process, and to achieve reasonable goal during learning new knowledge and skills. Metacognition is a guideline for instructors to know that what can individuals do, what should they perform, the strategies which are effective for learning process, to notice students challenges and opportunities during learning process, communicative teaching and learning, reflective teaching, and learning tasks, etc.

2.2 The effectual learning strategies to adopt and support individuals learning process

To support and develop individuals' learning capabilities a lot of learning stratagems can be useful for instructors to construct learners' learning styles as the following principles and guidelines.

To which impactive strategies can students appeal for their learning process?

Learning is a complicated process, and it may not be too simple as someone imagines. Some factors are effective to wield learning strategy. For instance, the nature of learning materials, assessment strategies, learning objectives, and the instructional methods can render some strategies more effective than others (Scouller, 1998; Sebesta and Bray Speth, 2017). Strategies for learning can be characterized as deep if they involve extending and connecting ideas or applying knowledge and skills in new ways (Baeten et al., 2010). Strategies can be characterized as surface if they involve recalling and reproducing content. While surface strategies are often viewed negatively, they are times when these approaches can be effective for learning (Hattie and Donoghue, 2016). For example, some learners may not ready for learning new knowledge and skills according their schema or background knowledge about new leaning contents or foreground knowledge and skills. Therefore, they will appeal to

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[1] De Carvalho Filho (2009).

[2] Kotiat and Bjork (2005).

wield surface strategies to surfeit their background knowledge. On other hand, leaners may integrate deep strategies to develop, link, and use that knowledge and skills. To use surface and deep strategies is urgently based on learners' expectations and boundaries about their learning process and goals which have been set by instructors or their internal or inherit talents and calibers for learning new knowledge and skills. So, if learners are conscious about their learning expectations with instructors; learning strategies will be effective.

To apply effectual learning strategies; which obstacles may learners encounter during to wield metacognition for their learning process?

To use metacognition for learning process, learners may experience and wary about some learning challenges and obstacles. For instance, some individuals may imagine that some learning strategies which are evidence-based, are not visibly effective for their learning process. Students can be provided with data showing increased performance after use of evidence-based strategies; however, instructors should note that the belief that evidence-based strategies do not work may persist even in the face of student's own data (Roediger and Karpicke, 2006). Sometimes students prefer to use some strategies and methods which are not effectively but they were previously effective for their learning process. students may be willing to change how they study, but they may need to develop accurate procedural knowledge, which involves knowing how to enact a strategy, or they may need develop conditional knowledge, which involves knowing when and why a strategy is appropriate for a learning task (Stanton et al., 2015). Instructors to assist learner's metacognition knowledge development for conditional and procedural knowledge, they can model some strategies that orient to a learning practice and to give them opportunities to perform that strategy. In other cases, students may know how, when, and why they should use effective strategies, but they may not decide to use them because those strategies cause them discomfort (Dye and Stanton, 2017). Following important questions relate to above statements.

How can learner's suite some challenges which they may encounter during to use an effective learning strategy?
How can instructors wield effective methods to assist learners to conquer the available challenges?

2.3 Recommendations for students to wield effective strategies for their learning process

Some effective suggestions that learners should use to learn more effectively such as spacing, self-testing and interleaving. Learners space their studying while they arrange their learning contents for multiple times. So, students should persuade to use these strategies when they are metacognitively regulating their learning activities. This strategy requires individuals to premediate their learning goal instead of to focus just which is next practice. The second strategy can help students to control their understanding about material and detect their learning gaps and deficiencies during understanding new knowledge and skills. In fact, students can apply flashcards and reply to exercise questions during their struggle to recognize knowledge and skills. Self-testing also allows students to activate relevant knowledge and encode prompted information so it can be more easily accessed from their memory in the future (Dunlosky et al., 2013). Spacing and retrieval practice that is recalling knowledge from memory can be combined. For instance, Self-testing strategy is an aspect of retrieval practice. Retrieval practice with spacing encourages students to actively recall the

same content across several study sessions, which is essential for consolidating information from prior study periods (Dunlosky et al., 2013). Importantly, when students spread their learning over multiple sessions, they are less susceptible to familiarity with concepts, which can mislead them into thinking they have learned concepts based on recognition alone (Kornell and Bjork, 2008). Students interleave when they alternate studying of information from one category with studying of information from another category. For example, when students learn categories of amino acids groups, they alternate studying nonpolar amino acids with polar amino acids. This allows students to discriminate across categories, which is often critical for correctly solving problems (Rohrer et al., 2020), or when learners during learning noun types; they can categorize nouns to countable or uncountable or nonrenewable and renewable energies or they can divide animals to domestic and wild animals, verbs to action and nonaction or state verbs, etc. To interleave between categories also help learners to learn, since it is always in result of spacing about study. Most research has focused on what strategies students select and use for learning, but more work is needed to understand how students use those strategies (Kuhbander and Emmerdinger, 2019), and why they wield them which according to figure 2.3 both of metacognitive knowledge and metacognitive regulation are intercalated. Learners' ways of learning for same learning strategy is completely different because they are different according some features. For instance, one learner to report a textbook may read the passages of book passively but other learner may use selective strategy for reading the passages of book for clarifying the weird area.

2.4 Metacognition and enhancing learning process

Learners always demand to wield metacognition for promoting and expelling positively their learning process. So, metacognition is thinking about learning process, facts, events, and learning strategies. Using metacognition during learning course can juxtapose learning gaps and learners will achieve insight about their learning strategies and materials. In fact, metacognition will effectively help individuals to be more independent during learning process to achieve their learning aims. Unfortunatly approximately most of learners are not alert about their learning performances weaknesses or their ability, and lack of awareness may be harmful for educational developments. Metacognition strategy is an effective factor for learners to gain confident upon their learning process if it be appropriately and logically presented by instructors during a learning course. Metacognition also succor learners to identify their deficiencies about learning outlines and topics and they can profoundly understand their learning process and materials.

2.5 Metacognitive strategy and classroom tasks

To encourage learners to pilot their learning process is metacognition key. It means students should dynamically and actively engage and reflect on their learning process instead just looking, studying, and saving learning materials that it helps them to weather and withstand during to do learning tasks. Learners must drive their memory to be more aware in learning environments. In fact, developing learner minds dynamically help them to understand that learning process is not an inert and fix, but it is an active process and it requires to interact rudimentary with learning materials and to waive redundant activities that they may led to reproach learning practices. Appling metacognition in classroom help learners to be more adopted and resist with difficult and impossible learning

challenges and situations. To use metacognition can help students to ask themselves some questions as their lessons main purpose and ideas, the difficulty levels, if lesson is weird how can I ask my teacher effectively, and how can I reasonably perform when to get stick in implicate problems. Following tips are effective metacognitive strategies and practices for classroom tasks.

2.5.1 Thinking Journals
Applying thinking journals, can effectively improve learners learning ways and it will develop their capacity to plan, control, and evaluate themselves. It can help students as an effective learning instrument to reflect positively on how to speculate meticulously. In fact, thinking journals will encourage learners to investigate, question, link ideas, and to determine about their learning tasks. Journals can be wielded for different goals as the following principles.
–To record ideas from a lesson, film, presentation, etc.
–To make predictions about what will happen next.
–To record questions.
–To summarize and restate the main ideas of a book, film, etc.
–To reflect upon and connect the ideas presented to other domains of knowledge.[3]

2.5.2 Reciprocal Teaching Strategy
In reciprocal teaching strategy learners can play teacher roles or they can be surrogate instead teacher to help their classmates. Reciprocal teaching is a strategy used to develop reading comprehension (Palincsar and Brown, 1984). For reciprocal teaching strategy teachers present their learners four significant strategies (questioning, clarifying, summarizing, and predicting) to enhance reading comprehension skills, then learners take the teaching models to help other students.

2.5.3 Mnemonic Strategy
Mnemonic is a strategy for teaching process that teachers should wield it to help learners for recalling difficult information that individuals cannot remember them ordinarily. Mnemonic strategy can present in two strategies. First word mnemonic or expression which learning items classify in a regular list according to their first letter to combine new words or phrase. For instance, '**MCHALE**' can be used for mechanical, chemical, heat, atomic, light, and electrical. The second strategy for mnemonic is to use visual objects to help information recalling. During image mnemonic, teachers can use their hands to recall some numerical events and facts such as days of a week, etc. Mnemonic strategy is constrained to some metacognition strategy impedimenta, but it can tremendously help individuals to recall new information about their learning process.

2.5.4 Metacognitive Talk Strategy
Metacognitive talk is a strategy which speaks a learner a loud while he/she is performing learning tasks. This strategy may be observed by teacher during classroom activity and it is always an annoying or disturbing behaviour in class environment which can distract learners' concentration and focus about learning materials. But speaking aloud can help students to have more attention on their learning process. Also they can cognitively control their performances and it helps them to have a deep understanding of their thinking. Talking aloud can help learners to use during planning, monitoring, and evaluating stages. Teachers should use metacognitive talk strategy when they teach a new skill by talking and describing it aloud and orally. Indeed, verbalizing aloud teaching materials can help learner to understand and solve their learning gaps more efficiently. Metacognitive talk will also assist and induce individuals to interact with teachers and their classmates. "Students also use social metacognition when they assess, modify, and enact on another's strategies for solving problems" (Van De Bogart et al., 2017). While enacting problem-solving strategies, students can evaluate their peers' hypotheses predictions, explanations, and interpretations. "Importantly, metacognition and social metacognition are excepted to positively affect on another" (Chiu and Kuo, 2009).

2.5.5 Exam Wrappers Strategy
Exam wrappers are papers which are presented and analyzed for leaners some questions about their performances or test results. In fact, it is a biofeedback in form of worksheet after or before they will receive their test results or real feedback. After to receive real test feedback, students should ask to review the results to classify errors and to discuss how can they perform differently for the next exams. Providing students with answer keys that include explanations of the correct ideas and reflection questions can support students in evaluating their learning[4]. Exam wrappers strategy is to adapt new idea to help students to be more cognitively alert about their testing errors and solving them for the next testing sessions. Instructors can help students monitor their understanding more accurately by encouraging students to complete practice exams and giving students feedback on their answers, perhaps in the form of a key or class discussion[5].

2.5.6 KWL Charts Strategy
KWL charts is a metacognition strategy which used to observe individuals, plan, doing, and to review learning process. The main aim of **KWL** charts is to answer some questions as: What do they learn, what do they prefer to learn, what did they learn. **K** is known, **W** is for want, and **L** refers to learning process. The first question can be reply at the beginning of course that learner how many know about learning materials. So, this can activate learners' schemata or previous knowledge and experiences and will easily identify and highlight their weaknesses or misunderstanding about new learning contents across their learning schemata. The next question caters some ideas to wield for future learning tasks in form of how, when, or why questions. Finally, the third question or what did they learn; students can cognitively find out whatever they have previously learnt about new lesson contents.

2.5.7 Writing Essays Strategy
To compose an assay requires professional metacognition strategy and it can help learners to organize their implicit thoughts and apprise their talent and capacities about surrounding world events and facts. Like think aloud protocol or reflective thinking; writing assays can increase students' ability to recognize what didn't they previously know and how are they speculating about learning concepts. Writing outlines about

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[3] Costa, Bellanca and Fogarty (1992).

[4] Sabel   et al (2017).

[5] Rawson and Dunlosky (2007).

what learners know and some questions about learning contents for learning knowledge and skills.

2.5.8 Rules about Asking for Help Strategy
Teacher can set some effective rules in classroom to motivate learners more instead students as soon as they require to assist. Teachers can pursue their learning to speculate cognitively what do they really require to find about their learning tasks or which section of their previous performances exactly need to enhance before referring to teachers. It also helps learners to practice self-piloting learning. For example, social metacognition happens when students share ideas with peers, invite peers to evaluate their ideas, and evaluate ideas shared by peers[6].

2.5.9 Traffic Lights Strategy
To use traffic lights strategy during learning process can be used by learners for recognizing some harmful or useful learning facts. For instance, red color can insinuate to important or dangerous facts, amber color can be a sign for the facts which are not too important or a little danger, and green color can imply to safe facts or easy problems. Traffic lights strategy can be used in primary schools.

2.5.10 Feedback Strategy
To present effective feedback for students can help them to deliberate about their learning performances and it alert them how should they improve their learning process. However, feedback is a key to expand metacognition.

2.5.11 Reflective Thinking or Thinking Aloud Protocol Strategies
Reflective thinking or think aloud protocol is a learning strategy which involves talking about learning materials. Learners can orally communicate with their classmates, their outdoor friends, tutor, or just a pet, a kitty, or teddy bear. To verbalize thinking can assist learners to express and link their feels with learning materials and poring profoundly about learning materials. Reflecive thinking is an effective strategy to assess ourselves what I have Perfectly understood about learning contents. Think aloud can cognitively help learners to solve and explain their learning problems and find their learning gaps. Furthermore, metacognition comprehensively depends and links to reflective thinking, and brainstorming strategy can reply and find answer to some self-reflective questions.

2.5.12 Goals Strategy
To goad learners to categorize their learning aims is the best strategy for individuals to identify their learning developments and to review wherever they require to change their learning métiers. Learning goals may be challenging, but they are effective perchance to develop and construct new learning knowledge and skills.

2.6 Research Results and Metacognition
To review research results and findings can help teachers that how can they recognize their learners' capacities about their own learning tasks and process. For instance, according one research findings learners classified into four groups such as tacit, aware, strategic, and reflective learners[7]. **John Flavell** (1970) is the prominent scholar in metacognition and learning domains. He does prominently diversity of researches about

child knowledge and monitoring their own memory process and procedures during learning tasks and to achieve new information and skills. The education instruction in psychology domain has emphasized on significant role of metacognition to enhance students learning process. Furthermore, Flavell is the earliest scholar perhaps the first one to research in metacognition and learning. By 1960-decade scholars have focused to investigate how can learners control their memory contents and procedures. Since 1970s, scientists have described some models and strategies about memory and information processing which includes to control primarily the cognitive process. By the 20th century; researchers have found the importance of metacognition, monitoring, and controlling for reading comprehension developments. **Lev Vygotsky** (1896–1934) have developed the theory of Zone of Proximal Development (**ZPD**). This boundary has been focused on what can individuals learn according to their own learning ability and what can they learn plus experts' helps. According with this idea; teachers initially accept responsibility for controlling learning progress, to set learning goals, to organize and design learning tasks, and to allocate sufficient attention in learning process. Learning responsibility gradually for cognitive process returns over own individuals. So, students can independently regulate and pilot their cognitive tasks. As results of limited researches finding about positive effects of cognition and metacognition for learning process it can be predicted that both strategies can develop learners learning capabilities and they will enhance memory function for learning process. Cognitive process involves attention and to activate schemata and to wiled cognitive strategy to figure out the weird problems and to complet learning tasks conveniently. On other hand, to use appropriately cognitive strategies; learners demand to have self-awareness about their learning activities and they should monitor and adopt themselves with new learning tasks and strategies.

2.7 A Checklist for Metacognition Principles
Primary principle to use metacognition is to illuminate learning purpose for individuals. However, learners should understand what are learning materials to regulate their plans to achieve learning goals. Students should recognize their previous strategies and identify new strategies. The next principle is to apply effective strategy to encourage students to learn and to monitor their learning process. Indeed, teachers can ask some questions and encourage learners to focus on learning contents and speculate about their endurance while they are concentering and engaging to learning materials. Teachers should provide some effective opportunities for students to be more attentive and independent learners. In fact, to pilot learners' developments and purvey apposite feedbacks is essential for learning process. Furthermore, teachers should provide some criteria for individuals to reflect critically about their learning progress and process. Also, to judge their learning achievements to make logical decisions. So, learners should get sufficient time to analyze their performances of a particular learning task. To wield thinking journals strategy is the most effective way for learners to reflect on their learning process. Ultimately learning environments should provide a secure atmosphere and status for students to apply metacognition efficiently in classroom to support learning process. To establish a secure learning environment, requires to make an interactive and collaborative

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[6] Goos et al (2002).

[7.] David and Perkins (1992).

situation in class. Also, group working endows learners a diversity of plausible opportunities to be more prone and encourage to perform correctly their learning tasks and to be more self-reflective learners.

2.8 Metacognition Strategies for Classroom Assessment

To know the gaps between learners' understanding and test goals, teachers should encourage learners to take themselves some quizzes instead of to pursue or highlight their own textbooks. This not only boosts long-term retention but also bridges the gap between familiarity with a topic and deep understanding of it [8]. Students may ask themselves some questions before a test as why and what is tests for, which areas I cannot learn, how much time will I demand for the following test, do I study well and have I suitable location to study well, which effective learning strategies should I wield for a test, and what acceptable point will I get during a test. Metacognition can also be use after a test. Do not let students receive a grade test and file it away without using it as a tool for further learning. Try using exam wrappers, short handouts that students complete after a test is handed back. These worksheets incite students to review their test performance and improve their study strategies throughout the school year[9]. Learners should ask themselves while or after a test some questions as which items did I answer wrong and why, am I well-prepared for test, why I perform differently, etc. Students generally do not need to evaluate in high school because they are able to perform well in many of their classes without studying[10].

2.9 Metacognition and Teaching Strategy

The main role of teachers in classroom is to increase learners' capacity to develop their metacognitive strategies. To teach metacognitive skills across other lesson contents is recommended by education researchers. Following metacognitive practices can be perform by teachers to promote students learning tasks and their learning process.

2.9.1 To facilitate metacognitive through lesson structure and environment

Teaching materials should be constructed for students so that they can wield metacognitive practices. However, teachers demand to divide lessons to four arenas. First: **You**, second: **Plan**, third: **Do**, and Fourth stage **Review**. In **You** stage teachers should present their learners some introductory strategies which they can diagnose them according with their schemata or prior knowledge and skills about new lesson topic. But during **Plan** strategy, learning tasks should be set up for pupils. Learning aims must be clear or understandable and explicit contents. So, Learners will design and regulate their plans to approach learning goals, which strategies are suitable for their learning tasks, how much time they will require to perform the tasks. Furthermore, they can apply and allocate exact effort and attention to predict their real potential for doing learning tasks and practices. While **Do** stage, individuals will apply their efforts to perform the tasks, and piloting their advancements. During this stage teachers should present their learners to take rest, provide them sentence scaffolding strategy for feedback or to reflect about their learning performances. To highlight confusing problems is very essential due to it indicates learners

that learning obstacles and impedimenta are integral parts for learning activities. To notify what learners don't recognize for understanding can help and leads to use efficiently metacognition.

2.9.2 To purvey appropriate challenges and opportunity for learning tasks

Learners always like to learn challenging subjects and prefer to achieve effective opportunities which link with learning tasks. Always interesting or challenging events can be remembered conveniently rather than easy or uninteresting facts. Indeed, lesson contents should not be very challenging or very interesting, and that lead to overloading cognitive strategy for individuals and it will culminate to failure to think and learn. Therefore, to provide explicitly some tasks for effective learning should be accordingly with students interests and metacognitive capacities and abilities. Teachers should present some models for learners how to monitor and review their knowledge and skills, and how to link schemata to newer ideas and strategies about learning activities.

2.10. Metacognition Advantages for Teaching and Learning Tasks

The first vantage of metacognition is a factor which helps and goad individuals to be more independent students. Indeed, metacognition rules and aspects can assist learners to pilot their own achievements and to monitor them as they are performing their learning tasks like reading, writing, listening, etc. It also helps to figure out the real meaning of difficult problems. The second merit of metacognition practice is its positive impacts for learning activities. Metacognition emanates and donates an equal and unique utility for learning tasks over and beyond the effects of professional ability. Too often, we teach students what to think but not how to think[11]. The next befit of metacognition is it does not restrict and bound to a distinct range of students and special education instruction. In fact, metacognition is useful approximately for all instructions and a wide range of learners that can benefit from metacognition practices for teaching and learning activities. The main domain of metacognition practices can include K–12 learners. It can also be wielded by university students to help for their own educational and personal uses. Metacognition skills help students to convey whatever they have learned from current knowledge and practices to the following context and to link and converge previous activity to a newer task. This task, knowledge, and skills can embed mathematics, reading comprehension, to memorize knowledge and skills, reasoning and problem- solving, writing, etc. Finally, metacognition is not too expensive for education instruction. However, in contrast to other education instruction strategy and instruments; to implement metacognition skills for teaching and learning tasks, are cheap and don't require to provide expensive materials and equipment. In other words, metacognition needs to apply intellectual and professional curriculums and programs and to require experienced or seasoned teachers according their field of teaching territories.

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[8] Adesope et al (2017); Smith et al (2013).

[9] Gezer–Templeton et al (2017).

[10] McGuire (2006).

[4] OECD Insights (2014).

2.11 Misconceptions and Metacognition

The first misconception about metacognition; it is a simple deliberating about deliberating. Metacognition process is the thinking about their thinking procedure but it is not so complicate than imagine. Furthermore, metacognition is to pilot dynamically our learning tasks and to change positively learning behavior and strategy according controlling ideas. Following misconception is that every strategy which learners use to perform cognitive skills is metacognition. Some people believe that to use phonic frames for decoding and vague vocabulary while to read is cognition skill. Strategies used to make cognitive progress are cognitive strategies; strategies used to monitor cognitive progress are metacognitive strategies[12]. The other misconception is that teachers do not play significant roles to develop their students' metacognitive skills. So, students should focus on their learning tasks and monitor their own learning activities teachers should help them to develop appropriately their metacognition practices. Teachers require to present and set useful learning material, focus, and check metacognitive skills, also to advocate and support their learners during learning tasks. Finally, many researchers believe that metacognition skills are just engage adult students. Metacognitive skills do not emerge until a child is 8 to 10 years old[13].**Whitebread** and **Pino Pasternak** (2010) have presented several research studies which indicate some evidences that young learner metacognitive competencies. Based on this researcher findings infants while are 18 months; they demonstrate to amend or emend their errors and when they are 5-year-old kids can reflect about their forgetting process, etc. Although this group of learners not enable to represent their metacognitive process they have engaged with metacognitive process.

Conclusion

Memory is an essential part of brain for information processing and learning. Perceiving information and processing must actively pass diversity of stages such as to store, retrieve and recall input and information. Many years ago, approximately nobody did not probe and know a lot about memory premises, but today by doing diversity scientific researches about brain and memory it is not a bizarre matter of fact for us. Human memory is like a computer system but they are different according some latent and patent aspects. Without to have a healthy memory to moderate information processing and learning is impossible. Memory and learning can be occurred explicitly or consciously by practice or following special instructions and schedules. On other hand, learning may occur implicitly or unconsciously without doing no exercise or following any instruction. Consequently, memory is obviously an alienable part of our brain which its real nature is resilient and it can help to hold and process a limitless and a great amount of information and it can effectively impact on our learning process positively or negatively. It can also assist learners to prolong and perform their learning activities. To encourage teachers and learners to use metacognition in classroom is an effective strategy to teach and learn new knowledge and skills. Metacognition will assist them to develop their genius capacity, to improve brain function, self-consciousness, reasoning practices, solve integrate problems and increase their latitude for learning skills. To use metacognition strategy can help learners to be prepare for doing learning tasks and to have positive attitudes toward performing assiduously learning activities. Metacognitive skills wil promote learners' self-conscious ability to recognize and discriminate irreverent, irrational, or weird facts during to perform learning tasks and practices. It can also help learners to adopt absolutely themselves with new skills and strategies. Metacognitive strategy will manifest for learning status to evoke listless and indifference learners to participate and adapt themselves to vague situations of learning process and tasks. While metacognitive skills amalgamated and merged to other strategies like cognitive strategy; learning process can help effectively students to learn more conveniently. Metacognition incorporates diversity of strategies as planning, monitoring, and evaluating. These strategies can endow a lot of utilities learners to indicate that learning process should be conspicuously purposeful rather than aimless instruction. Furthermore, it can be argued that metacognition practice is a pivotal strategy which can precisely assist learners to challenge with quaint problems and it will pertinently cater learners several useful and optimize opportunities and options for individuals to increase their tolerance for ambiguity and interrogative capacities. Metacognitive strategies have been recommended by a lot of educational scholars that it will effectively help learners to perform their mental scripts consciously and to juxtapose their schemata to new knowledge and skills, to solve their learning problems logically, to figure out difficult learning problems, and to make effective decisions for their learning métiers. To use metacognitive practices will also help students to be more performance-based and creative members of their group and to enjoy from learning tasks without any premonition about learning progress. Indeed, metacognition can incorporate some strategies as to predict, summarize, decoding and encoding information, give more illuminative examples for learning events and facts, how to sketch some useful learning plans, how to allot enough time for learning activities, how to rain behaviour, how to reconcile, how to refrain, how to retain information, how to detect invisible facts, how to be impartial in some learning situations, how to get the gist matters quickly, how to be more self-reliant learner, etc. Metacognitive strategy can stimulate and provoke learners to be more dynamic learners in learning environment. Metacognitive knowledge can be divided into three knowledges as declarative, procedural, and conditional knowledge. Subsequently, metacognition is a spontaneous meditation process about our own thinking process and procedures in memory that leads to perpetual orientation toward learning protocols. So, it can conclude and suggest from second part of current research that education instructions and teachers can efficiently apply metacognitive strategies across cognitive strategy to set up and regulate their education curriculums and instructions.

Key Term Definitions

Cognition

The mental and brain ability to recognize knowledge and skill through thinking, experience, and observation.

Meta

Meta is a term which implies some terms as about, across, after, and beyond.

Metacognition

Metacognition is a term which can involve be aware and to have curb about our personal brain process and activities.

Reflective learners

. [4] Flavell (1981)

[5] E.g., Vemman and Spaans (2005).

Reflective learners, besides of strategic learners; they always reflect on their learning process and their thinking métiers, learning achimenes, gaps, etc. This group usually consider the effective strategies or not effective one. They also revise appropriately current and previous learning strategies.

Scaffolding strategy

Scaffolding is appropriate opportunities that some teachers provide learners to support students to construct their learning competencies and to develop their learning understanding and current levels of practice. Also, it will develop individuals' confidence and independency capability.

Self-aware learner

Self-aware learners are conscious students that alertly and confidently know about their thinking process. This group of learners always perform and organize their learning tasks accordingly with their predetermined schemes and aims.

Strategic learners

Strategic students always use problem-solving, decision making, evidence-based, grouping, categorizing strategies to find the effective ways for doing their learning tasks. They can wield the effective strategies that assist them to learn more efficiently.

Tacit learners

Tacit students are not always aware and conscious their thinking procedure and learning process. They do not any thinking about their strategies and learning tasks. So, they will accept all the knowledge and skills whether correct or mistake.

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