Cognition, Memory Types, Functions, and Language Learning Strategies

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Introduction

What does the mind consist of and how does it function? Does the mind lead our learning process towards perfection? Cognitive psychologists attempt to structure the organisation of our mind into cognitive levels, mental processes, and memory types purposefully, not for the sake of distinction but for the sake of comprehensiveness, in order to help us understand how our mind functions. Thus, this paper attempts to answer the above stated questions and provide an overview of the major concerns of information processing in cognitive theory in order to demonstrate that short term, long term, dynamic, active, working memory and episodic, semantic tacit memory types are not distinctive parts but correlative interdependent mental processes that come into play when we are performing our daily learning strategies. Remembering our 'first day at school', recalling when one learns the meaning of 'honesty' or how one 'takes notes in a lecture' without paying attention to spelling and handwriting are all examples of complex mental processes and tasks that are generated by memory types. Exploiting these mental processes and memory types in pedagogical settings provides teachers with strategy based instruction techniques and learners with language learning strategies.

1. Cognition: cognitive science and psychology

In an attempt to understand the human mind, Kintsch (etal.1984: 16) give a broad definition of cognitive science in general by considering it as 'a collection of several pair-wise intersections among anthropology, computer science, linguistics, neuroscience, philosophy and psychology.' From first glance, this definition includes terms that are classified in alphabetic order because one wonders how computer science may be mentioned before linguistics, philosophy and psychology.

A second consideration of this definition tells us that cognitive science is a multidisciplinary subject which requires a comprehensive study of human mind evolution starting from anthropological findings of ancient societies (called primitive, even if findings proved their elaborate-intelligent way of life), taking into account philosophy and linguistics as major human contributions into the understanding and the expression of man's own ideas, focusing behaviour studies on the individual's behaviour and development, and at last investigating neurological structure of the brain, comparing the human thinking processes to create artificial intelligence in the field of computer science.

Furthermore, Anderson (1995: 10-12) considers that there is somehow a slight difference between cognitive science and cognitive psychology. Of course, Anderson adheres to the aspects of the definition of cognitive science as stated in Kintsch (1984.ibid) mentioned above. But he says "Cognitive psychology broke away from behaviourism in response to developments in information theory, artificial intelligence, and linguistics." He further adds that cognitive psychology emerged after World War II as a response to the failure of behaviourist theory to deal with behavioural problems which could not be explained or solved by behaviourist psychology pattern of stimulus- response relationships. Anderson even states that cognitive psychology had its basic foundations academically established by two major events: the first one was the publication of a very important book -*Cognitive Psychology*- by UlricNeisser in 1967, and the second one was the beginning of the *Journal of Cognitive Psychology* in 1970. Anderson, thus, considers the emergence of cognitive psychology as prior to the emergence of cognitive science which he dates back to the appearance of the *Journal of Cognitive Science* in 1976. According to Anderson (1995. ibid) and many other scholars (Gardner, 1987; Stillings et al, 1995), Cognitive psychology started with the study of perception and attention as major elements of information theory, then moved to more elaborated research on learning, remembering, thinking, problem solving, decision making, and language.

2. Information Processing models, computer sciences and learning

The early cognitive trends, which studied information processing, were based on the speculation that the human mental operations could be compared to the functioning of a computer in dealing with a number of digits. Two major works of the 1970's – Massaro (1975) and Mayer (1977) attempted to bring the issue into the learning process with more or less success in moving away from the stimulus response model towards and elaborate thinking/problem solving challenge. Massaro (1975: 39-40) states that 'the stages of mental processing include: detection recognition and reaction (…) which lead us to consider information processing as the processes we have identified between stimulus and response (...) and can be clarified in terms of our information-processing analysis. Stimulus is the information available to the detection process which transduces the physical signal into a neurological code.'

Massaro (1975:42) Figure 1:

Stimulus detection → recognition → response selection response →

Massaro (1975: 64) Figure 1 bis: on memory search

Test digit: detection recognition memory search response selection → response and comparison

Massaro (1975: 248-257) Discusses the relationship between the storage structure in immediate memory and the psychological process at each stage of processing information through visual recognition. Massaro considers that the visual stimulus leads first to perceptual visual storage and then to recognition and storage in immediate memory. These three - perception, recognition and immediate memory- stages are followed by the rehearsal stage which in turn will lead to the recall stage. Hence recall (remembering) cannot take place unless there is enough rehearsal of the items stored in immediate memory. Massaro (ibid) adds that:

'(…) the central assumption of our information-processing model is that a number of processing stages occur between stimulus and response. These processing stages are assumed to be successive and each stage operates on the information available to it. The operation of a particular stage takes time and transforms the information, making it available to the next stage of processing. Two theoretical constructs are important to this approach. First, the structural construct describes or defines the nature of the information at a particular stage of processing. Second, the functional

construct describes the operations of a stage of information processing.' (Massaro, 1975: 599-600)

To explain this assumption of an information processing model, Massaro (1975: 601) draws a flow diagram of the temporal course of auditory and visual information processing. He distinguishes first the stimuli as sound and sight wave patterns which lead to an auditory and visual receptor system. At this step he considers the stage of feature detection or sensation which is followed by perceptual auditory and visual storage. This storage helps in establishing primary recognition. Massaro calls this a perception stage which develops the interpretation of signs. It is followed by synthesized auditory and visual memory which represents a secondary recognition and leads to a stage of conception – concept formation. Concepts are then stored in a generated abstract memory. They are recorded and rehearsed through a last stage that Massaro calls knowledge of rules. According to this model, recording and rehearsal act as a feedback to generate more concepts in abstract memory and reinforce synthesized items in auditory and visual memory.

Mayer (1977:133) makes a close link between information processing, thinking and cognition. He considers that the information approach to thinking assumes that a human being is (…) a processor of information whose cognitive processes, including thinking, can be presented as either:

-a sequence of mental processes or operations performed on information in the subject's memory; or

-a sequence of internal states or changes performed on information that progress towards a goal

We can add, then, that this represents a certain number of moves the subject undertakes to solve a problem.

More recent works give information processing the place it deserves in educational psychology: (Anderson. 1995:12-18), (Matlin.2003:10-13), (Slavin.2003:173-187), (Woolfolk.2004:239-271), (Baron and Kalsher.2005:164-172), and (Ormord.2006:42-49). All these scholars agree on the fact that the initial

research was inspired by computer science and most of them lead the discussion into further developments of information processing theory and its impact in the field of learning and teaching but those who limited the scope to cognition (Matlin.2003) rather diminish its role.

According to Anderson (1995), the information processing approach became predominant in cognitive psychology, and attempted to analyse cognition into a set of steps in which an abstract entity, called information, is processed. On the one hand, the paradigm showed how an individual saw a probe stimulus which had to be encoded and then compared to each digit in the memory set. Then, the individual had to decide on a response and generate it. Time required for stimulus perception, decision making, and generating a response was of high importance in this paradigm which accounted much more for mathematical operations and relations of digits. Anderson (ibid) adds that Sternberg paradigm of digits, though, essential, needed much more contribution from the environment, physiology and the complex neural representation of information in the brain. On the other hand, Matlin (2003:10) considers that one component of the information processing approach is to interpret the mental process as "information progressing though the system in a series of stages, one step at a time". Matlin claims that these stages are: First, reception of stimuli and comparison with information stored in memory; Second, seeking additional information stored in memory; Third, making a decision; and finally, executing the response. Matlin considers that the most prominent example of this approach was the model developed by Atkinson and Schiffrin in 1968 which had great influence on cognitive psychology. The model proposed that memory is a sequence of discrete steps in which information is transferred from one storage area to another. The first step of the model is the sensory memory which gets the external stimuli for a few seconds. The second step is the short term memory (which is now called working memory) that gets, from sensory memory, some small amounts of information and uses it during some seconds (about 30, according to Matlin). The third step is where material and information that have been rehearsed pass from short term memory to long term memory for relatively permanent storage.

In this model, most of the received information in sensory memory is lost unless there is a certain amount of focus of attention and perception. Short term memory requires rehearsal so that information is understood and stored in long term memory. In a criticism of this model, Matlin (2003:12-13) admits it had a great impact on further developments in cognitive psychology but considers that this impact diminished in recent years because, and for matters related to convenience, psychologists focused their investigations on two broad aspects of learning: -kinds of memory and their interrelationships, and; - a theoretical framework that accounts for an information processing model.

This second aspect is closely related to our educational research and investigation. Perception, rehearsal and retrieval, being major characteristics of the information processing model, are the most important stages of a programmed learning experience. The type and amount of information the learners are exposed to, the type and quality of activities suggested for rehearsal and retrieval account that much for learners' proficiency development and achievement of learning objectives. While the information processing approach lost its impact in cognitive psychology but paved the way to memory and cognitive style research fields, it gained grounds in educational psychology as a framework for the design, implementation, and evaluation of the learning process. Moreover, the cognitive studies of memory rather confirmed the idea that organised, intentional and tactical-strategic learning improves memory abilities, as we shall see in the following sections.

It is, thus, logical that some trends of cognitive psychology - which do not rely on response as a model of changing behaviour-, diminish the role of information processing and focus on cognitive levels. It is also consequent that some trends in cognitive psychology abandon the idea of immediate stimulus-response relationships-which favours a rush towards performance objectives achievement- and study the learning process as a model of information (subject/material and language) processing.

More recent works in educational psychology stress the fact that, even if first information processing models speculated over computer and artificial intelligence findings, it is sometimes the neuropsychological research (human brain functioning) which influenced developments in the world of computer operations. Slavin (2003:173-187), Woolfolk (2004:239-271), Baron and Kalsher (2005:164-172), and Ormord. (2006:42-49) consider information processing as a core approach to cognitive psychology in general and a central aspect of all specific descriptions of memory types as sensory memory, short term/working memory, and long term memory.

> "For most cognitive psychologists, the computer model is only a metaphor for human mental activity. But other cognitive scientists, particularly those studying artificial intelligence, try to design and program computers to 'think' and solve problems like human beings. Some theorists suggest that the operation of the brain resembles a large number of very slow computers, all operating in parallel (at the same time), with each computer dedicated to a different, specific task." (Woolfolk.2004:239).

We can add further that Ormord (2006.opcit) puts information processing at the central dynamic phenomenon of cognitive development in children. After a long criticism of Piaget's and vygotsky's views about learning, she devotes a whole chapter to the importance of information processing view of cognitive development. She comes to various outcomes of this importance in considering that all learning styles and strategies are the result of information processing theory.

> 'As teachers, we must remember that our students are likely to be less efficient learners than we are. A variety of factors that affect their ability to learn –attention, intention to learn, prior knowledge, awareness and the effective use of learning strategies, and so on- develop gradually throughout the school years. We can not expect that our students will always learn as quickly, or even in the same way, as we do. Learning strategies make such a difference in students' classroom achievement that

> we shouldn't leave the development of these strategies to chance. As we ask students to study and learn classroom subject matter, we should also give them suggestions about how they might study and learn it. Such an approach is consistent with not only information theory but also with Vygotsky's proposal that adults can better promote children's cognitive development by talking about how they themselves think about challenging tasks.' (Ormord.2006:48)

All recent four works, mentioned above, agree on the stages and models of information processing which are prominent in child cognitive development, learning, and problem solving. They distinguish aspects related to sensory, short term, working, and long term memory and provide models of processing like bottom-up/top-down and schema representation of knowledge and remembering. These elements require further discussions that we provide in the sections below.

3.Memory, remembering and memory types

It is common sense to say that a person remembers or knows something already known or learnt. This knowledge is generally stored in memory. The act of remembering is simply seen as a recall of knowledge items whenever necessary with or without effort. Remembering can thus be directed or incidental. If we incidentally meet an acquaintance, we may or may not remember the person; immediate recall of the person may be so quick that we do no even realize the act of remembering. But if it happens that we have a difficulty of remembering the person then we certainly try to activate various clues (circumstances, situations, dates, events, other relative relationships, etc…) which help us recall the person. Is this an organised or random activity?

Answering this question leads us to consider how memory is organised and how it works. In other words, if we consider memory as store of general knowledge and/or specific information, then there is certainly an access route to that store.Memory is not simply an act of remembering past events and acquired/learned knowledge and information; it is also the act of planning things we have/need to do in the future. There are things we set forth to be carried out

automatically as modes of behaviour implied by our automatic responses to immediate circumstances (walking, eating, going to bed, etc…). But, there are also various activities that we plan to do intentionally according to specific time schedule which has already been set forth to be executed at specific moments (calling up someone, preparing a lesson, visiting a doctor, etc…).

Memory can, thus, work 'retrospectively' and 'prospectively', to use Green's terms. This mental activity of remembering past knowledge and remembering future intentions is so problematic that a categorisation of memory into models is quite necessary. Green (1987: 37-58) rejects the idea of defining memory as 'a passive memory store (…), general knowledge of objects and categories and a permanent record of our personal experiences'. She underlines the fact that psychological studies of memory attempted to:

> '(…) distinguish psychological models of memory as long-term memory, semantic memory, autobiographical memory, episodic memory, short-term memory, each implying that different kinds of knowledge are parcelled out between various memory stores.' (Green.1987: 38-39)

She advocates the idea that memory is an active working process which involves almost always all the modes mentioned in her quote above. Green (1987: 39-41) first explains that active working memory is a shift from short-term memory which is considered as a short-term store, and defines it as:

> '(…) being a work space in which new inputs can be received and information from long-term memory can be retrieved. Working memory is necessary for cognitive functions which depend on an interaction between new and old information. (…) The emphasis of working memory research on active processing replaced the traditional concept of short-term memory as a passive store of to-be-remembered items, which had to be continuously rehearsed if they were not to be forgotten.' (Green.1987:39)

From this definition, we can say that this active working memory combines cognitive functions which are derived from both short and long-term memory in a

process of information reception, retrieval, interaction and rehearsal. It implies simply that active working memory is the space for information processing. Green (ibid) adds that this model of memory is not so perfect and can be seriously affected by a variety of factors:

-the number of items a human being is able to consider simultaneously;

-the state of consciousness/awareness of the problems we are working on;

-it contains only a subset of all the vast amount of passive knowledge available to us.

Cook. (1991: 65) defines working memory as "the memory system used for holding and manipulating information while various mental tasks are carried out" and adds that working memory needs an "articulatory loop which is the means by which information is kept in working memory by being audibly or silently articulated." Almost similarly, Fontana (1995:152-155) assumes that learning and memory are interdependent even though there is a psychological division, for purely pedagogical reasons, of memory into long-term and short-term memories which have an important relationship and the learning thus stored. He stresses the fact that received information can only be held in short term memory relatively briefly; it is either forgotten or transferred to long term memory where it can be stored. This transfer, according to Fontana (1995:153), is vital for learning and involves some form of consolidation which is achieved by a number of strategies:

-pausing, repeating and questioning (work sufficiently upon material); -chunking (breaking down material into small manageable units);

-relevance and interest (appealing to experience and feelings); -attention span (focus learning attention for a specific duration);

-practical use (a material used is a material remembered); -meaning (memory holds material which is meaningful);

-overlearning (practicing and revising make a material persist in memory);

-association (unfamiliar material is better learned and remembered if associated with familiar material: from known to unknown principle).

Fontana (ibid) adds that memory usually works on two levels of recognition and recall. It is easier for a learner to recognise material he/she already knows as far as

it is presented to him/her, but it is more difficult to recall it from memory without any cues.

All these view points about memory, its types, categories and activities, help us say that learning is an activation of memory processes of interrelationships and interdependence. Learning makes memory dynamic by applying various steps of information processing. The division of memory into two or three phases, spaces, or fields may vary among scholars, not for disagreement on activities of the mind but rather for the sake of convenience. Thus, while Slavin (2003: 173-175) considers the stimuli, their perception and focus of attention as "sensory register", Woolfolk (2004: 240-242), and Baron and Kalsher (2005:164-165) consider them as "sensory memory". Woolfok (ibid) even identifies "bottom-up" and "top down" processing as sensory aspects while Slavin (ibid), Baron and Kalsher (ibid), and Ormord (2006.opcit) do not. One can say that it is established among these scholars that the initial stage of learning (recognition, perception and attention) is the first memory space where learners identify features of new items whatever the styles, aspects or strategies they would use to do so.

4. Learning strategies

In previous discussions about learning styles, almost all scholars mentioned the relevance of strategies in the determination of some particular styles. Some, at times, use the terms interchangeably. However, in the pedagogical field where researchers are generally much more involved in classroom research and specifically in developing learning strategies, a clear distinction is made between the two terms with more focus on the strategies rather than the styles. For example, Oxford (1990) makes a thorough study of language learning strategies by considering that they have at least twelve characteristic features; she says that they:

1. Contribute to the main goal of communicative competence;
2. Allow learners to become more self-directed;
3. Expand the role of the teacher;
4. Are problem-oriented;
5. Are specific actions, taken by the learner;
6. Involve many aspects of the learner, not just the cognitive;

7. Support learning both directly and indirectly;
8. Are not always observable;
9. Are often conscious;
10. Can be taught;
11. Are flexible;
12. Are influenced by a variety of factors to make choices.

(Oxford.1990:09)

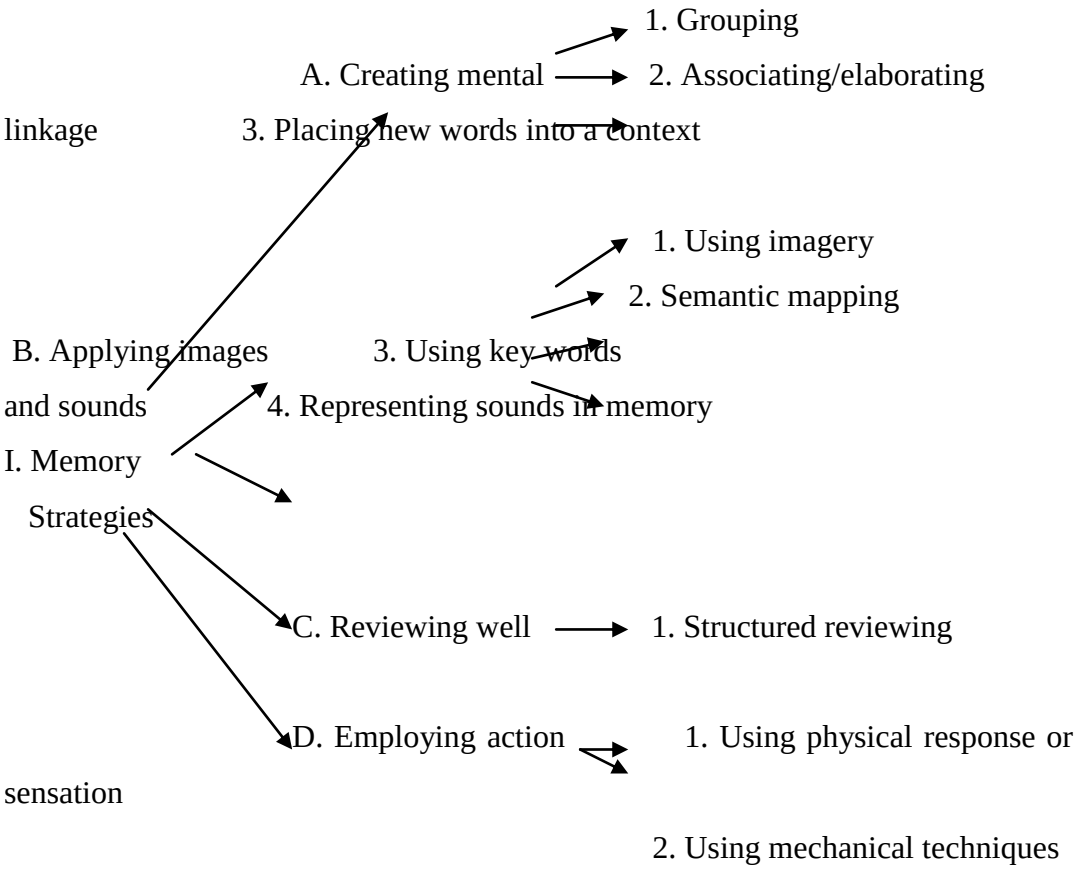
Though these features seem to be obvious from first glance, we can say that almost all of them characterize the learner's learning experience (features 2.4.5.6.7.9.11.12), while others characterize the programmed learning courses (1.3.4.8.10) and show that educational decisions can contribute by involving more people (teachers) in the development of learning strategies, and by designing specific aims (goals) and activities (problem-oriented). We can add that features 5 and 8 are somehow contradictory because one wonders how "specific actions taken by the learners" can "not be observed." The only explanation to this contradiction is that scholars attempt to explain learners' actions by inferring from, and relating learners' choice of a given strategy to, abstract cognitive styles.

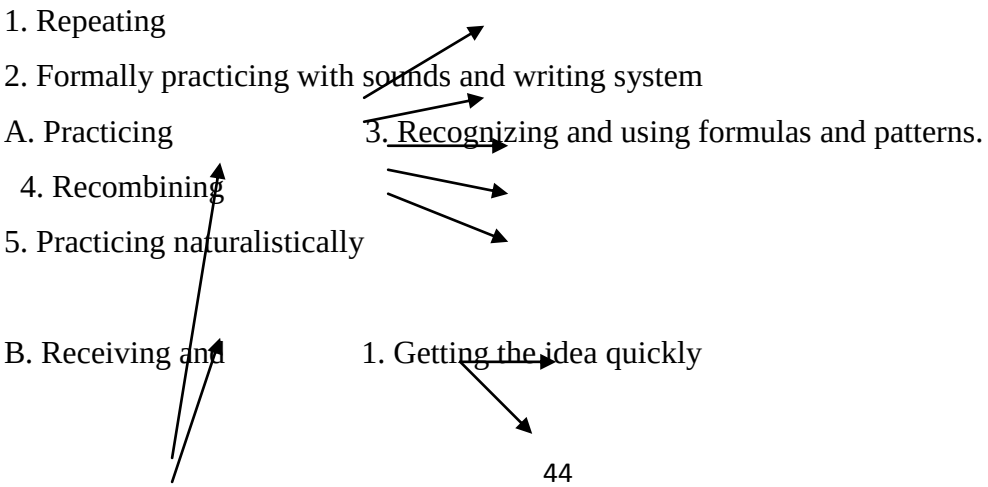
Oxford (1990:11-21) suggests two classes, six groups and nineteen sets of learning strategies and provides a diagram to summarize her taxonomy. It represents a taxonomy which combines both cognitive and personality factors affecting language learning. The initial distinction of two classes of strategies, direct and indirect, relies on, and looks similar to, the distinction between cognitive styles, field dependent-field/independent and personality/temperament factors made by Lightbrown and Spada (1999), Little and Singleton (1990), and Brown (2000) mentioned above. Consequently, each class has three groups of strategies which, in turn, have nineteen subdivisions that best illustrate what learners do when they are learning. For this purpose, Oxford takes this categorization into further details and supplies an exhaustive list of activities in a second diagram (which includes the first diagram as well). Each of the nineteen sets of strategies is extrapolated into guidelines for language learning activities which learners are supposed to

undertake under teachers' supervision or on their own independent learning experience (see Figure, below).

Direct Strategies

(Memory, Cognitive, and Compensation strategies)





sending messages 2. Using resources for receiving and sending messages

II. Cognitive

Strategies 1.Reasoning deductively

2. Analysing expressions

C. Analysing 3. Analysing contrastively (across languages)

and reasoning 4. Translating

5. Transferring

D. Creating structure 1. Taking notes

for input and output 2. Summarizing

3. Highlighting

A. Guessing 1. Using linguistic clues

III. Compensation intelligently 2. Using other clues

Strategies:

1. Switching to the mother tongue

2. Getting help

B. Overcoming 3. Using mime or gesture

limitations in 4. Avoiding communication partially or totally

speaking and 5. Selecting the topic

writing6. Adjusting or approximating the message

7. Coining words

8. Using a circumlocution or synonym

<u>Indirect Strategies</u>

1.Overviewing and linking with already know material

A. Centering your 2. Paying attention

I. Metacognitve learning 3. Delaying speech production to focus

on listening

Strategies :

1. Finding out about language learning

2. Organizing

B. Arranging and planning your learning

3. Setting goals and objectives

4. Identifying the purpose of a language task (purposeful listening/reading/speaking/writing)

5. Planning for a language task

6. Seeking practice opportunities

1. Self-monitoring

C. Evaluating your learning

2. Self-evaluating

1. Using progressive relaxation, deep breathing, or meditation

A. Lowering your anxiety

2. Using music

3. Using laughter

II. Affective Strategies

1. Making positive statements

B. Encouraging yourself

2. Taking risks wisely

3. Rewarding yourself

1. Listening to your body

C. Taking your emotional temperature

2. Using a checklist

3. Writing a language learning diary

4.Discussing your feeling with someone else

1. Asking for clarification or verification

A. Asking questions

2. Asking for correction

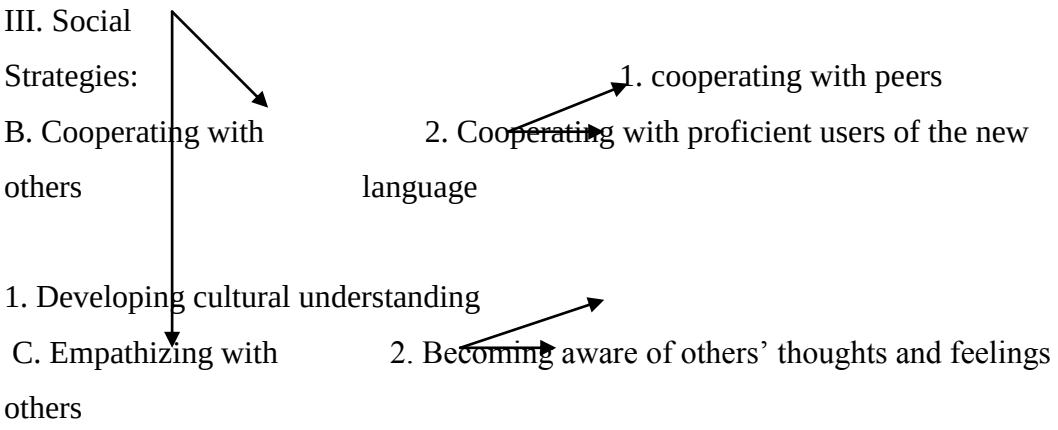


Diagram of the Strategy System Showing All the Strategies.
(Figure 1.4, in Oxford.R,L. 1990:18-21)

In a revision of this categorisation, Oxford (2001 in Carter and Nunan: 166-172) defines these strategies and renames memory strategies as mnemonic strategies.She considers that cognitive strategies help the learner establish and reinforce associations between old and new information, and facilitate the reconstruction of information in the learners' mind by use of such tactics as guessing from context, analysing, reasoning inductively and deductively, taking semantic notes and reorganising information. Cognitive strategies, according to Oxford, involve hypothesis testing like searching for clues in the material studied or in one's own knowledge by hypothesizing the meaning of the unknown item.

Mnemonic strategies relate one thing to another in a simple stimulus response manner but do not reinforce associations. These strategies are basically established by modelling the learners' behaviour to react to sounds, body movement and gestures, and by reference to a page, a picture, or something on the blackboard. Such tactics or moves are considered to be the first essential steps in learning vocabulary items and grammar rules with beginners.

Metacognitive strategies help learners know themselves better by identifying their own processes, specific learning tasks, interests and needs. In fact, metacognitive strategies are learners' awareness about their own learning styles and problem solving abilities. Examples of such styles are visual vs. auditory,

kinaesthetic, global vs. analytic, concrete, sequential vs. intuitive, random, and ambiguity-tolerant vs. ambiguity-intolerant.

Compensatory strategies help learners make up for missing knowledge in oral or written communication like using synonyms, circumlocution or gesturing to suggest the intended meaning. Oxford (2001 ibid) claims that these strategies provide an immediate opportunity for incidental learning.

Affective strategies are related to learners' feelings of anxiety, anger or contentment about the learning process itself. Such strategies can have negative or positive impact on the learning process because fear of failure and fear of communication may hinder leaning when learners' participation is criticised, while games and funny activities may relax the atmosphere and make learning enjoyable.

Social strategies are essential for communicative language learning as they establish learning relationships between the teacher and the learners, and among the learners themselves. Asking questions for clarification, asking for help, studying together inside or outside the classroom are group/social tactics that teachers should encourage; learners can sometimes learn more from each other than they can do by learning from the material or on their own.

Almost similarly, Brown (2000.opcit) relies on other scholars –basically the work of O'Malley and Chamot (1990) on 'Learning strategies'- to draw three major categories of learning strategies: metacognitive, cognitive, and socio-affective strategies. Brown considers all three as directly related to the receptive domain of intake, memory, storage and recall. Brown (2000) adds a category of communication strategies divided in two other sub-categories which are avoidance and compensatory strategies. Both categories are related to the employment of verbal or nonverbal mechanisms for the productive communication of information. This means that at the production stage, learners of a foreign language attempt to overcome their deficiencies in using the language by either avoiding an idea – a topic- or by creating their own locutions.

This makes five categories, each supplied with detailed strategies which are, more or less, similar to Oxford (1990 opcit) detailed diagram mentioned above.

In Brown's (2000: 125-130) terms, relying on O'Malley (1985), these five categories can be represented in the following two tables:

Metacogntive strategies	Cognitive strategies	Socioaffective strategies
-Advance organizers -Directed attention -Selective attention -Self-management -Functional planning -Self-monitoring -Delayed production -Self-evaluation	-Repetition - Resourcing -Translation -Grouping -Note taking -Deduction -Recombination -Imagery -Auditory representation -Keyword - Contextualization -Elaboration -Transfer -Inferencing	- cooperation -Question for clarification

Table 2: Learning strategies (Table 5.2, in Brown 2000: 125-126)

Avoidance strategies	Compensatory strategies
-Message abandonment -topic avoidance	-Circumlocution -Approximation -Use of all purpose words -Word coinage -Prefabricated patterns -Nonlinguistic signals -Literal translation -Foreignizing -Code-switching -Appeal for help -Stalling or time-gaining strategies

Table 3: Communication Strategies (table: 5.3 in Brown, 2000: 127)

If we compare Brown's categories of styles and strategies to Oxford's diagram, the following remarks may be of great interest to us and to the reader;

- all the terms used for memory and cognitive strategies (including the subcategories) in Oxford's diagram match with the terms used by Brown for only the cognitive strategies. Thus, for Oxford, memory strategies are distinctively identified from cognitive ones while for Brown both memory and cognitive strategies come under only one category.
- In both works, metacognitive strategies are described in almost identical terms but with slight difference in subcategory classification and order;
- Communication/compensation strategies also match in both works though the degree of precision and detailed description is more accurate in Oxford's work;
- Brown's socioaffective strategies are too general while Oxford's are distinct and much more detailed –affective and social strategies are set apart;

A much more global view of metacognition is provided by Wenden (1998:519) where she distinguishes metacognitive knowledge from metacognitive strategies. She defines metacognitve knowledge as "referring to information learners acquire about their learning", while she defines metacognitive strategies as "general skills through which learners manage, direct, regulate, guide, monitor, and evaluate their learning."

This definition seems to be a hierarchy of two levels: the first high level is a state of mental awareness about, a superego of, the learner's metacognitive knowledge – let us say a style, while the second level is a number of tactical, practical moves that the learner consciously chooses to use in order to tackle learning.

5. Practical examples:

For the sake of bringing a close relationship between theory and practice, teachers are guided towards the use of practical activities that encourage the learners to use their learning strategies. Actually, almost no strategy can be applied in isolation from the other strategies. Like the complex memory types interrelationship, strategies are used simultaneously in learning tasks; the two examples we provide below among post beginners and post intermediate learners illustrate best this complexity.

5.1. Post beginners' narrative task:

If post beginners are asked to narrate what happened on their first day at school, they would certainly remember a few moments they shared with their parents, friends and teachers, their impressions (feeling and emotions), and their value judgements of their own experience. When putting their ideas down on paper, they would use an Active Dynamic Working Memory combining their affective, episodic and semantic memories. Although the ideas might seem clear enough in their mother tongue, they would not be able to use properly their tacit memory rules (norms and conventions of writing) as they are still learning them; the learned rules have not yet been internalised as an automatic system of behaviour in terms of spelling, punctuation, gender and number correlation and tense relations.

5.2. Post beginners' note taking task

While listening to a lecture, learners are expected to take notes. The most essential shared background knowledge between the lecturer and the students is a conceptual framework of sematic knowledge. The lecturer relies on this schematic framework to deliver shared and/or negotiable information. The required active, dynamic and working memories come into paly explicitly. However, the auditory, visual and tacit memory types act implicitly as they are performed automatically. The post beginners have already acquired a set of tacit rules which help them interpret meaning, code it in notes that they would remember afterwards.

Conclusion

Theoretically, the human mind seems so complex and difficult to understand. Cognitive theory and educational psychology attempted through a number of studies to distinguish the mental operations and processes to help us (teachers) understand that complexity and consequently manage the relationship between it components: information processing, memory types and learning strategies); Practically, it is our role as teachers to make use of learning strategies with the learners in order to help them improve their potential learning abilities.

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