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ABSTRACT

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Multisensory Instruction in Foreign Language Education

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MULTISENSORY INSTRUCTION IN FOREIGN LANGUAGE EDUCATION

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ABSTRACT

This paper reviews some theories that through history have explained the process of learning. It also taps some new findings on how the brain learns. Multisensory instruction is a pedagogic strategy to cover the greatest number of individual preferences in the classroom, language laboratories and multimedia rooms for a constant and diverse stimulation of cognitive functions. Ongoing research focuses on the planning of activities that will foster cognitive functions under individualized learning experiences.

One of the unique characteristics of human beings is the ability to wonder at ourselves and be marveled by all that surrounds us. Since ancient times great thinkers have been asking questions like: What are we? What can we know? How do we learn? Certainly the way in which we have approached the search for answers to these issues has changed, but the same basic questions remain. In fact, other questions have arisen as a result of what we have learned about learning. Some of these include: How do neurocognitive functions develop in each person? Can we modify our learning process? How can educators intervene to make learning more effective and more efficient?

ACCESS TO KNOWLEDGE

Collectively, we have discovered a great deal about how our knowledge of the world is processed and stored in the brain. As a result, we now realize that a mechanical or even oversimplified physiological explanation of this process is insufficient. Thanks to research done in many of the different areas of scientific study, we have a much better understanding of human knowledge. It isn't possible now to talk about the intricacies of the learning process without making reference not only to psychology, but also to biology, sociology, physics, chemistry, and recently, neuropsychology. This is because what we have learned about learning is precisely the critical role that is played by the interaction among all those factors that make up our experiences. To apply on a basic level what current theories tell us, it may not be necessary to understand where they came from nor all the diverse stages of their development. However, in an educational setting (and especially in a university one), not taking into consideration the complex nature of learning (and therefore the complex role of the "professor") can have very undesirable consequences. On the other hand, anyone who seriously intends to further her/his knowledge about learning —in the UAM our role is that of professor-researcher— cannot afford to neglect an in-depth understanding of these interactions, as Figueroa (Meraz, 1983) clearly points out.

It is not our intention here to provide more than a brief introduction to this essential prerequisite —nor do we pretend to have acquired all of that knowledge as yet— but rather to mention where our research has led us up to now and what we are currently

implementing in the language department at the UAM, Iztapalapa Campus. We propose a holistic approach to foreign language education.

EDUCATION

Throughout history many a philosopher has said that it is education that which makes a human being human. Yet the idea of what education is has also evolved over time. On the one hand, it has become institutionalized, organized according to age and grades, is in many cases obligatory, and often involves many other prerequisites and unnatural restrictions. On the other hand, we have recognized that learning is not limited to classroom experiences. We now talk about the need for continuing education, distance education, and life-long learning.

Likewise, through the centuries, we have developed theories about how we learn and how our education should be conducted so as to be congruent with that theoretical framework.

We should know by now that education isn't simply filling our students' heads with a certain quantity of specific information, in spite of what seems to be promoted by the ever increasing tendency toward specialization in today's professional instruction. Nor is it getting our students to faithfully repeat what his/her professor presents explicitly in class. True education, we believe, promotes reflection on what knowledge is, what we know and how we come to know it, with the objective of using this metaknowledge to our advantage.

For Aguilar (1982), the priority goal of education is to develop in our students the *ability to learn*. According to Tirado (1983), educate means to form, not simply inform. What we want, he insists, is to *understand processes*, not just accumulate data. Gagné (Tirado, 1983) has said that the principal objective of education is to generate cognitive strategies that help make the student more perceptive, a better learner, with increased ability to remember and generalize acquired knowledge, which, as a consequence, favors more productive and creative thinking. Coll concurs that learning to learn is the most ambitious goal for formal education, something which is achieved through the mastery of learning strategies (Chadwick, 1997).

As university professors, we must seek to develop these abilities in our pupils. The preparation of curricula and study programs needs to be oriented toward the integral formation and development of our learners. To achieve this, we need to base our activities on the advancements that have been made in the understanding of learning processes.

LEARNING

While there may exist diverse definitions of learning, we'll start out with what seems to be common among the definitions given by the majority of the authors we have reviewed: learning is what enables us to adapt to our changing environment (Swenson, 1991) through the acquisition of "symbolic, emotional or behavioral" techniques (Woolfolk, 1988).

It's also important, for our purposes here, to take into consideration Woolfolk's comments about what learning *isn't*: It isn't limited to the classroom, it doesn't refer to

something that is "correct"; it isn't necessarily a deliberate or conscious activity, and it doesn't imply only factual knowledge or abilities - it also includes attitudes and emotions (Woolfolk, *op. Cit.*).

As in any discipline, the theories related to learning have suffered radical changes through the years. An important aspect to remember, nevertheless, is that most "new" theories are based to a great extent on previous ones. If we are to advance in the understanding of learning, it's essential to first understand the past and present theories and how they came to be.

LEARNING THEORIES

The first theories about learning tend to explain our behaviors in a very general way and present learning as the result of very simple mechanisms. As time passed, these theories refer more and more to specific phenomena and represent learning as a complex process.

Connectionism

Some of the first physiological experiments dealt with trying to measure the speed of impulses traveling in the human nervous system. As a result of these experiments it was possible to establish the association stimulus-response, which served as the basic premise for connectionism (or associationism) and behaviorism. Later discoveries that showed one could learn by simply observing others obliged theorists to modify their paradigm to include some activity within the individual as an active observer: stimulus-organism-response. This gave rise to schools like neobehaviorism (Bandura's vicarious learning), social learning and information processing theory.

Another offshoot of the physiological experiments, and parallel to but different from the view of connectionists and behaviorsts, is that of the *Gestalt* psychology. While the former insisted on studying the isolated parts of a phenomenon, this alternative approach claimed that any object of study must be taken as a complex whole, and studied as such. The *Phi* phenomenon, as the *Gestalt* theorists called it, states that the individual elements do not determine the behavior of the whole, but rather the way the whole is organized influences the behavior of its parts.

Little by little, the subject was seen as having an active role in the learning process. The computational associationism developed by Gagné made reference not only to things like sensory registers, but also to short- and long-term memory, expectations and executive control. It became ever clearer that the simplified stimulus-response model could not explain much of the complex learning that apparently takes place in higher intelligence organisms, like human beings.

All of these events led to the establishment of a new school of thought on learning, cognitivism.

Cognitivism

One of the basic tenets of this school is the idea of the constant creation and reorganization of cognitive structures. While the *Gestalt* psychology maintains that the object contemplated by the subject enters through our senses as a fully-organized whole, cognitivists affirm that it is the subject who restructures the incoming information so as to fit it into his/her existing cognitive structure and, at the same time, reorganizes those existing elements as necessary. What is important here is not the quantity of information or the number of times it is repeated, but rather the quality of it that determines how well it is stored and subsequently recalled.

A well-known representative of this school is Piaget. He establishes a direct relationship between biological and psychological development. For this theorist, the whole (as object) is reconstructed by the subject through *reflexive abstractions*. Development of the organism (learning) comes from adapting to new circumstances. The presence of a novel situation (loss of equilibrium) requires the organism to adapt (reestablish equilibrium) through *assimilation* of recognizable elements and the *accommodation* of new ones. The result is a reorganization of the cognitive structure.

Bruner and Ausubel are other representatives of cognitivism. Bruner promotes learning through discovery, based on intuition and induction. Ausubel is known for his work on *meaningful receptive learning* based on deduction. He promotes the use of pre-organizers to activate existing knowledge and provide a macro concept under which the new information can be meaningfully arranged. Ausubel categorizes meaningful learning into cognitive factors and affective-social factors.

MEANINGFUL LEARNING

Commenting on the difference between mechanical, repetitive exercises and meaningful learning, Novak and Gowin (Pozo, 1987) claim that accumulative practice is always subordinate to meaning; and meaning is idiosyncratic and must be constructed by the student him/herself.

Pozo (*op. Cit.*) integrates the ideas of Bruner and Ausubel in a theory which tries to explain *conceptual change*. Deeply-rooted ideas —like those with strong emotional content attached, or those highly determined by one's culture and collective world view— are very resistant to change and may require revolutionary-like experiences for that change to come about. Such resistance could be the result of individual beliefs and personal history, or it could be related to social-cohesion factors and the need to belong to a group. This brings us to two other derivations of the cognitive theories of learning: constructivism and social-cultural (or social-historic) learning.

Constructivism holds that the subject is responsable for constructing her/his own knowledge, since new information must be linked in some way to that which already exists in the cognitive structure of the individual, and this previous knowledge is, of course, unique in each person. The social-cultural school puts additional emphasis on the importance of interacting with peers as an integral part of the learning experience.

One advocate of social-cultural learning theories is Vygotsky who states that learning occurs first in the social realm (interpsychic level) and later is internalized by the

subject (intrapsychic level). He speaks of the *Zone of Proximal Development* which refers to a level of learning that is only possible through interaction with others. The importance of social interaction in the learning process has been recognized more and more in recent decades.

There are other factors that come into play, of which it's worth mentioning learning styles and learning strategies.

LEARNING STYLES

Learning styles refer to individual differences related to how we perceive and process information and how we relate to our environment. Among the diverse classifications mentioned in literature, three basic styles have been identified: auditive, visual and kinesthetic.

The recognition of the importance of learning styles obliges the teacher, advisor or guide to take into account these individual differences in his/her students. This requires us to take a look at multisensory learning situations, which enable us to reach more students more effectively. Individualizing the learning experience a —making it *meaningful*— appears to be one of the keys to success in modern day pedagogy.

Another important factor that often influences learning in a negative way is that of not knowing how to learn. Most students don't use strategies that could help them achieve meaningful learning. (Muria, 1994).

LEARNING STRATEGIES

We often solve problems without being aware of how we do it. According to Muria (*op. Cit.*), this "cognitive repression" results from an incompatibility between the schemes we use consciously and those we employ subconsciously. We need to develop the ability of metacognition – consciously reflecting on these processes to better control them at will.

These strategies are themselves learned concepts. Perhaps more important than any other curriculum content is that which teaches learning strategies. Muria (*op. Cit.*) suggests that our teaching methods are responsible for the strategies that our students employ. If this is the case, it appears that we teachers need to review our own learning (as well as teaching) styles and strategies.

All of the aforementioned may seem to suggest that an eclectic approach to learning and teaching is called for. Indeed, a return to research into human physiology (and especially neurology) has revealed that our brain is in fact a fascinating and extremely complex organ. Present day research in neuroscience has shown that most of the theorists on learning have been, to some degree, correct. Even completely contradictory theories seem to be reconciled by recent discoveries about how the brain works. While information about our world does indeed enter through our senses, our mind does not "see" or "hear" things exactly in that way. In fact, it completely misses a lot of the information as it is lost in different points along the way. To compensate for this, the brain "makes up" data to complete the puzzle, often using information it already has stored; it "guesses" at what the missing pieces might be. The nervous system and the brain do indeed depend on a chain of stimulus-response relations, but numerous other

enhancing or inhibiting stimuli can modify this behavior significantly. The organization of the whole reveals operations that are immensely more complex than a simple summing of its individual elements. New fields of study have been born that help us to make sense of this pot-pourri of theoretical knowledge and relate it to the concrete results of present-day research.

After reviewing these different learning theories in an effort to explain some factors that influence knowledge acquisition, and comparing them to what recent studies have shown us, we conclude that in order to take advantage of research findings and put them into practice, it is first necessary for educational institutions to provide well-organized learning experiences and simultaneously for the learners to implement a variety of cognitive strategies. Since the objective is to cover the learning preferences of most students, activities in the classroom, laboratories and multimedia rooms must aim for a constant and diverse stimulation of cognitive functions. The cognitive functions and the correlation with brain structures are the subject matter of Neuropsychology. This discipline has done research in the way the brain works. In the UAM, we are making an effort to develop curricula compatible with brain functions to facilitate learning and store the acquired information efficiently on a long term basis.

As we understand more and more how the brain works, we foster a change in the way we approach the teaching-learning processes. However, each human brain is unique. Therefore, there is not a "best" way to teach or learn (Jensen, 1998). This is why it is so important to provide multisensory learning experiences able to cover the greatest number of individual preferences.

MULTISENSORY INSTRUCTION

Multisensory learning is easier in an enriched environment of varied elements to develop brain functioning (Tileston, 2000). The teacher as a facilitator of new neural growth, the presence of challenging elements, feedback and an active student, assure a proper environment for learning.

Research indicates that the brain learns better under a frequent and varied multisensory stimulation. Different teaching and learning styles as well as the different senses and sensations of the human being, must be involved permanently to guarantee learning (Tileston, *op. Cit*). Dhority (1998) mentions that an optimal learning environment is rich with multisensory, comprehensibly contextualized input that is not artificially sequenced.

Before mentioning some practical applications that help to produce this stimulation in students, let us review some basic concepts about the brain and the senses.

BRAIN FACTS

Seventy percent of the neuronal functions are developed in the cortex. There are four identified lobes: occipital (responsible for vision), frontal (responsible for judgement, creativity, problem solving and planning), parietal (responsible for the high sensory function processing and language) and the temporal (responsible for audition, memory, meaning and language). We now read about a fifth lobe, the limbic system, which is important because of the structures it is made of, such as the thalamus, hypothalamus and amigdala among others. This system is responsible for emotions, dreams, attention,

smelling and many others. Finally, the cerebellum is responsible for equilibrium, posture, movement and some areas of cognition.

Information that comes from the outside enters the brain by means of the five senses (Sousa, 2001). All the sensorial stimulus reach the brain as a flow of electrical impulses that result from the neurons that fire in sequence over the specific sensory pathways. The brain does not perceive light waves nor hear sound waves, but certain specialized modules of neurons process the electrical impulses created by the light and noise waves and the brain perceives them as vision and hearing.

The stimulus must be strong enough to be registered by our senses. Moreover, the brain tracks the information and the importance it could have for the person. All the sensory information that enters is first sent to the thalamus which in a matter of milliseconds monitors the strength and kind of the sensory impulses. The thalamus uses past experiences of the person to determine the level of importance of the information.

Besides the lobes, we have two hemispheres, right and left, connected by a package of neural fibers known as the corpus callosum. (Incidentally, this structure is thicker in women —20 million more fibers— than in men). Basically, the left half processes the information in a sequential mode, fine motor functions and positive emotions. The right half controls gross motor functions, math, problem solving and negative emotions.

However, the brain does not work exclusively in a global way or in a localized one, but rather in combination. Even though there are certain areas of the brain that are specialized, the brain also works as an integrated system, with multiple sites for similar tasks.

The brain learns through three simultaneous steps:

1. A stimulus starts the process (internal or external)
2. Processing of the stimulus occurs at a cellular level (electrochemical reactions) and
3. A memory potential arises.

Learning is perceived when the individual's activity reinforces or modifies his/her previous knowledge or when something new is achieved. Repeating what we have learned gets the neuronal paths to be more efficient each time. That is, learning happens when we stimulate the brain. It learns with new, challenging and coherent stimulation. This information is organized and stored in complex neural nets for subsequent retrieval.

Thus, for effective learning to take place, it is necessary to arouse as many sensations as possible. Not only is it necessary to stimulate but also to assure and verify the retrieval of the information.

The more we learn, the more the brain structure changes. Recent studies indicate that new neurons grow with an appropriate stimulation (at least in the hippocampus, an area responsible for memory) (Jensen, *op. cit*). This means that there is a huge potential for continuos learning.

EDUCATIONAL APPLICATION

There is a need for implementation of varied teaching strategies that cover the different learning styles. In a traditional class where the teacher does the talking and the students listen to him/her, the information will be getting only to 20% of the students, those whose learning style is auditive. Approximately 80% learn under a visual or kinesthetic style (Tileston, *op. cit*).

Auditive Style

Students with auditive style do prefer oral explanations from the teacher and tend to be successful in traditional teaching. However, Sousa's (*op.cit*) studies demonstrate that a great majority of individuals tend to stop paying attention to oral explanations after 15 or 20 minutes. In children it is about 10 minutes. Thus, it is recommended to give the oral explanations in the first 20 minutes of the class, that period of time in which learning is best. It should be new and important information.

Visual Style

The second learning style is visual. Visual learners need a mental model they can see. Tileston (*op.cit*) considers graphic or concrete models as the most effective tools for these kinds of learners. These mental maps help students to understand and retrieve difficult concepts as sequence, comparison, contrast and classification. They represent a good teaching strategy and a very important tool for visual learners. These concrete models help students to connect and relate new information to previous knowledge. Concrete models can be used at any time during the teaching process and they are very important in that specific moment when the teacher wants students to use the given information. They are also useful when it is time to ask questions before the evaluation. Whenever we help a visual learner to "visualize" the information, we also help him/her to process it in long-term memory.

Kinesthetic Style

The third modality is the kinesthetic learner. Kinesthetic information is processed in the upper area of the brain in the motor cortex. Once it is learned permanently, it is stored in the cerebellum. These students learn better through movement and touching. It is necessary to give students the opportunity for campus visits, acting, being outdoors, moving around the classroom, standing up. While moving, the flow of fluids to the brain increases and learning is improved. Just asking them to stand up to give the answer is useful.

Learning will increase in a classroom that involves different teaching strategies for different learning styles and when new information is given in the first 15 to 20 minutes (Tileston, *op.cit*)

These data demonstrate the need for systematic research on the processes of teaching and the processes of learning in order to improve the conditions and the results. Moreover, it is necessary to implement different strategies and make proposals. We should remember that the teacher can make a difference in the brain development of his/her students.

CONCLUSIONS

One of the numerous factors we want to take into account in planning foreign language learning experiences is the unique way in which each individual receives and processes information. The kind of environment we then want to provide is that which promotes multisensory learning; and the content of those experiences should be primarily opportunities to discover ones own styles and strategies and to learn how to develop them and use them to one's advantage.

Curricula that are based primarily on very specific content are by nature finite and their application is often limited to certain very specific situations. Taking this approach to an extreme, it would be impossible to cover all the knowledge a given student might need in his/her lifetime. And if we consider the uniqueness that characterizes the experiences, interests and needs of each individual pupil, we soon see the inadequacy of such methods. Learning strategies, on the other hand, are highly transferable and mostly independent of content. Focusing on this type of learning environment —learning general strategies and developing learning styles— with content which is chosen by each student or selected according to his/her learning profile will provide more satisfactory and long-lasting results. Learning then becomes a self-motivating activity. Externally imposed requirements are incidentally fulfilled, but are relegated to a secondary position and become non-issue items for the student.

Learning within a classroom is certainly enhanced by mastery of such abilities, but life-long learning outside of a formal educational setting, most definitely requires it.

The language department at the UAM Iztapalapa supports and promotes these alternative approaches; it already has two multimedia labs, one self-access center and has just equipped two new multimedia classrooms.

It is in these learning spaces where we intend to apply what we have learned from our bibliographic inquiry and to carry out ongoing research, through the design of activities that will foster multisensory stimulation and provide individualized learning experiences.

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