

COGNITION AND THE TEACHING-LEARNING SYSTEM

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ABSTRACT

The progress knowledge and information technologies has significantly influenced education and the form of teaching-learning systems. The intention is a change to the teacher-pupil relationship placing the classroom center stage the learning and the interplay among students, and the collaborative engagement of the teacher as agent of change. Another axis of educational change comes from the educative system approach throughout information and communication technologies (ICT's). The command of computer knowledge by teachers is necessary a) to equate their pupil's skills and b) to implement it into teaching strategies. Technologies such as e-mails and the Internet are essential tools for modern development of education. Cognitive systems known as dual, are composed of an automatic system and another system, generally a slower and thinking one. This combination allows the creation of an interface between the mode in which the brain processes information and the mode in which the teaching-learning system uses ICT's to improve the pupil's skills.

JEL: I21, I22

KEYWORDS: Cognition, Education, Information Technology, Learning

INTRODUCTION

The scientific and technological progress of the last decades, mainly in the field of the ICT's, mainly the ones linked to the ICT's, means more and better opportunities to extend education, allowing a reduction of the *time and distance* problem through innovations; the latter covering also the teaching-learning systems. As a result, the new methodologies of study can promote the "learning to learn" concept. Understanding this latter is the tool needed to develop an autonomous knowledge,

Each institution decides to integrate or not to integrate ICT's, according to their infrastructure, interests or skills. This problem appears in the 21st century as a great digital gap (not yet corrected) in the educational environment. The problem has magnified since 2006 with the emergence of cloud computing. This concept is orientated to the use of diverse applications and services for which it is necessary to have an internet connected PC.

Technological progress of the current century generates a projection for a virtual education, supported by digital tools such as Internet, videoconferences, social networks, professional networks and online libraries. The user pupil or teacher gains access to archives and programs stored in an indefinite site, even in other countries, which are not in his/her computer. Hence the origin of the term cloud. Many teachers of secondary and higher education have acquired their competence for cloud applications in training courses in recent years. However, they were not trained in this kind of environment and for that reason a great ignorance exist about dozens of free educative applications available.

Díaz Barriga (w/d), examined the possibility to obtain satisfactory results from the didactic situations to which people have been faced. Many times they have learned to learn, because: 1. They control their own learning process, 2. They recognize and appreciate what they do, 3. They appreciate the demands of the task and respond accordingly, 4. They plan and review their own achievements identifying hits and errors, 5. They employ appropriate strategies to analyze each situation, and 6. They value the attained achievements and correct their mistakes

The legacy of the French psychologist Gabriel Tarde (1903) is used in the psychological analysis of this work. Tarde's research concerning processes of cognition, decision and rationality were recovered in recent years by Montgomery Latour & Lépinay & Lépinay (2008) who presented a theory on the mode in which people realize the cognition processes based in imitation and creation, the latter being unique to humans (López & Sánchez Criado, 2006; Nocera 2006; Denegri Coria w/o date).

Analysis of the behavioral model of Tarde (Montgomery Latour & Lépinay, 2008; López & Sánchez Criado, 2006; Denegri Coria w/o date) has relation with the two systems model, named S1 and S2 by Stanovich & West (2000). This model is sustained by rationality models and validated by means of justifications providing the necessary support (García Campos, 2008, 2009; Stanovich & West, 2000, 2003; Vieira Cano, 2008; Estrada Gallego, 2006). It is directly related to education, because it indicates the form by which human beings acquire signification, starting from rational processes, as a necessary step towards comprehension and acceptance of reality and knowledge.

The purpose of the paper is to interpret difficulties encountered due to the advancement of information technology and new forms of education. This work continues with a literature review. Next, we present the methodology section that develops the different epistemological positions. Finally, the paper closes with some discussion and the conclusion.

LITERATURE REVIEW

The Behavioral Model of Gabriel Tarde

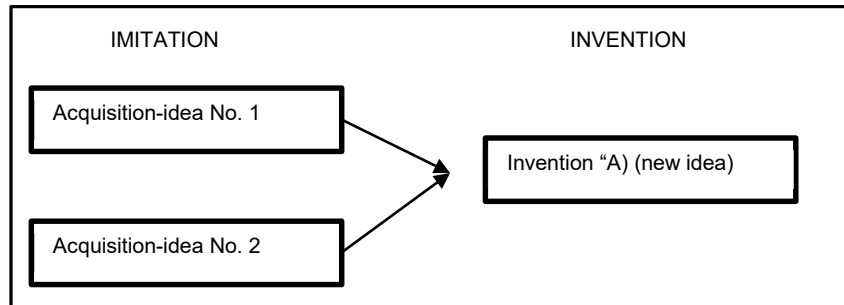
According to Denegri Coria (w/o date, p. 10) "Tarde claims that the social behavior is explained by means of the complementary concepts of imitation and invention". Imitation is the crucial phenomenon to explain human relationships starting from individuals. It is a kind of hypnotic state that leads individuals to repeat automatically the conduct previously developed by models. Imitation is the psychological procedure by which ideas are repeated and spread among society, starting from internal states such as beliefs and desires.

Imitation allows Tarde to claim that social reality is a result of psychological states, resulting from the association of individuals, allowing the construction of a group psychological representation. Then, the level of reality are the grouped individuals and the collective effect on the individual conscience (López Parra, 2008). Therefore, group construction of the psychological reality imposes conditions to the group components into an attitudinal and sentimental reference frame. In this framework individual decisions are adopted. In contrast to Gabriel Tarde (1903), Gustave Le Bon (1896) introduced the "collective mind" concept, claiming that when individuals are part of a collective, psychological traits emerge that are absent in subjects taken in an isolated mode. Instead, Le Bon (1896) states that some psychological behavior exist and emerges spontaneously as a consequence of their reunion.

The concept of invention is more important for human development, because it allows evolution starting from certain recognized situation, by means of imitation, to a new realization, invention. This evolution permits individual progress at the knowledge level as society progress. Meanwhile, Denegri Coria (w/o date) defines invention as *any thinking or creation that arises from the combination of two or more ideas acquired previously by means of imitation and by contrasting and opposition between imitation, accepted*

idea, and the existing practices, as shown in Figure 1. Features of individuals especially talented, are followed and copied by the *human mass*. The society advances thanks to inventions and creations.

Figure 1: Behavior Model by Tarde



Studies by Afternoon assume that human beings act in two ways: by copying ideas or actions through repetition, which is the usual way to proceed; or achieving an invention (new fact) that requires prior knowledge more an act of creation. In this way knowledge advances and societies increase their knowledge through inventions. Source: prepared by the authors

The idea on which Gabriel Tarde (1903) works has two well differentiated aspects, but simultaneously and perfectly related and complemented to explain the form in which human beings incorporate concepts and ideas. Concepts and ideas change humans, able to realize rapid decision making and to acquire and store new knowledge, by means of imitation. Tarde states that imitation and repetition are adequate instruments for the acquisition of abilities and skills by human beings. These instruments may be applied by means of *creation*, understood as the sum of two concepts already seized, that may only be available to those who possess a remarkable degree of cognition and reasoning.

The model of behavior suggested by Tarde (1903) implies certain laws that may be applied to education to explain that: 1. Imitation may explain either fashion or productive processes and cycles of teaching-learning, 2. The *homo economicus* is explained (in psychology) by the causes of desire and beliefs, 3. The *knowledge consumer* is a being made of desires to satisfy, according to a gradation of preferences, 4. Learning depends on the imitation concept, 5. Research is related to technological innovation, i.e. with invention.

The Dual Reasoning Model

The dual reasoning model is also sometimes referred to as the two systems model. The dual theory of systems was developed in the field of cognitive psychology and captivated the attention of an important group of psychologists. This theory has developed steadily since 1990. The theory postulated two diverse processes of reasoning that coexist into the human brain, called S1 and S2 by Stanovich and West (2000).

For Evans (García Campos, 2008, p. 68) and Stanovich and West (2000, 2003), S1 contains processes shared only with animals. S2 is a system used exclusively by human beings at large. These authors assign to the S1 system a rapid response capability, great operative capability, computational capability, which enables immediate responses, including to complex reasoning problems. The drawback consist of the fact that answers are not always correct. This system is deemed innate for human beings and archaic in terms of evolution (García Campos, 2008, 2009). Instead, S2 is a slower system of reasoning, but able to meet certain regulatory requirements leading to a more correct answer in terms of rationality. Moreover, this system has capacity, in some measure, to control the *outputs* of S1 and to inhibit them.

Stanovich and West (2003) stated that S1 is a compound of some processes that shared certain distinctive characteristics, common but liable of identification, such as: 1. They are associative processes or processes experimental learning, 2. They are perceptual and language systems, and 3. They are automated processes.

In an ulterior paper García Campos (2008) stated a relationship between the dual theory of reasoning and the concepts of justification and rationality. He argues Justification is a compound of two essential axes:

- a) A “*fundational*”-coherent axis; in “*foundationism*” has two elements. It is: 1) a series of basic beliefs exist that are not liable for justification, because they are the base to justify the universe of “not basic” beliefs; 2) the justification has only one direction: it goes from basic beliefs to no basic beliefs. While, “*coherentism*” adopts one level or status of beliefs and therefore, justification is bidirectional.
- b) The second axis is formed by “*internalist-externalist*” theories. In *internalism*, justification depends on internal states such as reflection, reasoning or memory, to which an experimental subject has immediate access. For “*externalism*”, justification depends on the *external state*, that starts from an individual’s own beliefs that leads to products of an adequate process of cognition.

Defenders of internalism argue that rationality criteria are the possibility to give and to offer reasons and underlies the notion of justification. Those who defend the externalist position suggest that justification entails the idea of inferential processes of induction and deduction. An important definition is the concept of rationality, for which the position of Stein is adopted; he (quoted by García Campos, 2009) called it the “standard vision of rationality” as follows:

“According to this vision, to be rational means thinking in agreement with the principles of reasoning based on the rules of logics, probability and so on”. Assuming that the standard vision of reasoning is correct, then the principles which we must apply to reason are the normative principles of reasoning” (Stein, quoted by García Campos, 2009, p. 66).

Therefore, in this context the rationality is the primary criterion to evaluate human behavior using the rules of logics, mathematics, probability and decision theory. Another definition of rationality exists, called the consequentialist view of rationality. According to this viewpoint, rationality is subject to the achievement of certain results proposed in advance, for which it is necessary to know the obtained results for an assessment of the rationality of an action.

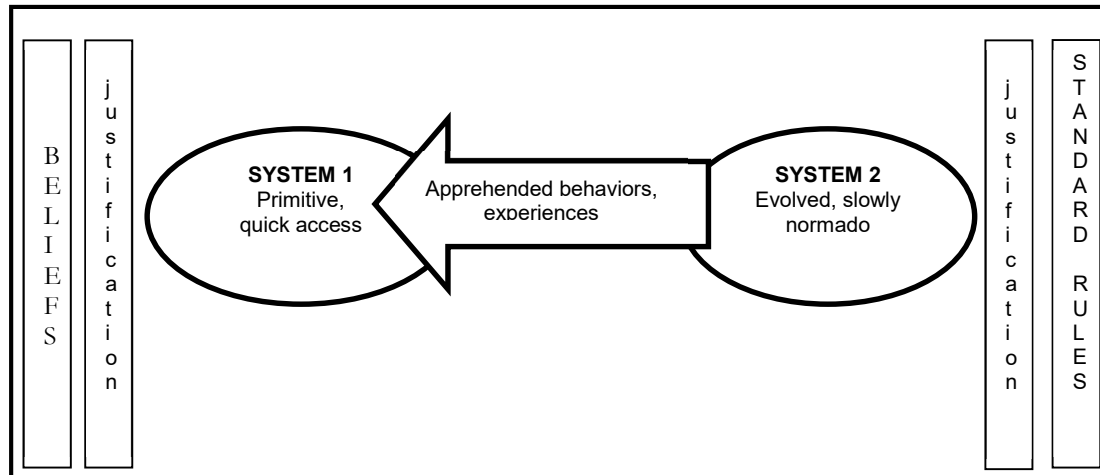
Figure 2 shows the relationships between S1 and S2 and the forms of justification and rationality. We see that rationality (R1) has a relationship with the consequentialist vision, while rationality (R2) is related to the standard vision of rationality. Then, for certain problems it is possible to offer multiple answers. While for R1 an action might be desirable and rational. However, R2 will not necessarily verify this condition under the postulates of rationality 2.

Recall the concept of rationality (R1) is in accordance with certain principles indicating the response to an event. The answer is esteemed as correct because it complies with the requirements of beliefs that are not necessarily verifiable from the *standard* point of view, because it is not a consequence of a ruled reasoning. Instead, if the response system corresponds to rationality 2, the process for decision making becomes responsible for validating the response. S1 is a system without access to the processes, but one that has knowledge of the outcomes, whose rationality is implied and instrumental into a genetic level. Their justification relies on basic beliefs that do not require demonstration (axioms and postulates). It is *consequentialist*-evolutionist.

The dual model explains the human brain responds to a stimulus with one of the two systems named S1 and S2. Meanwhile, each system must be admitted by means of a rationality mechanism conferring confidence to the response. Also, both systems must be validated by means of appropriate justifications. S2 signifies a slower and difficult reasoning procedure, requiring will and decision of the person to operate and a normative frame indicating adequate procedures to identify the correct answer to different stimulus. It usually acts according to the standard notion of rationality or another standard known beforehand. It

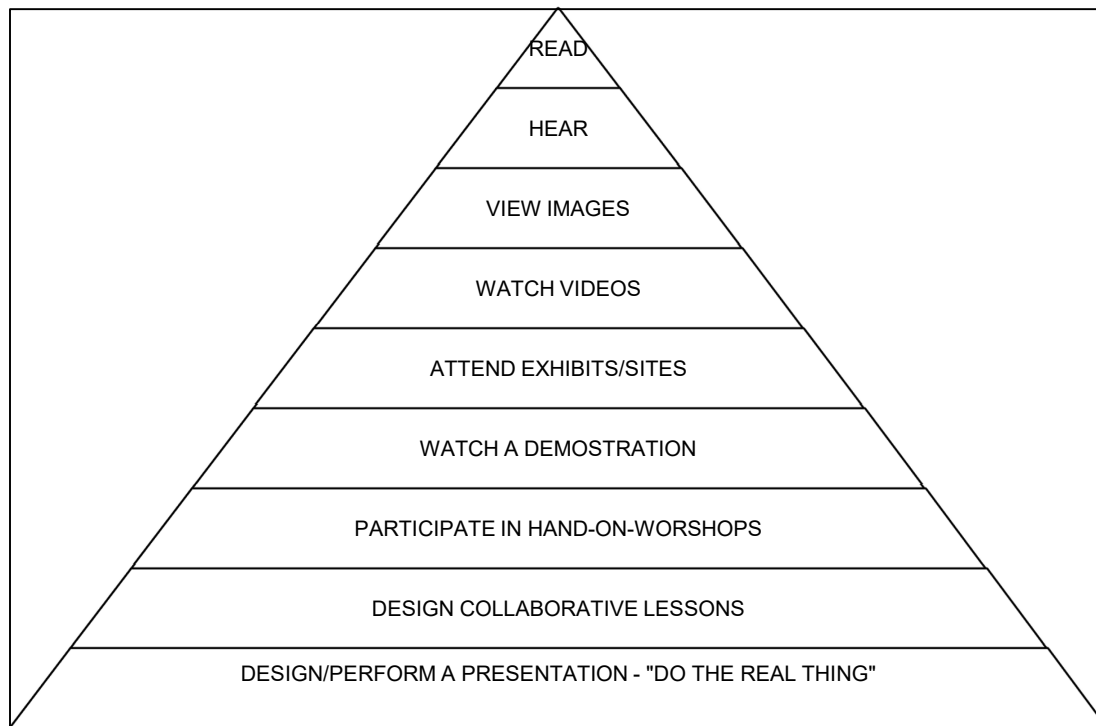
applies the rules of logic, mathematics, probability and decision theory. It finds justification in explicit models, because the process is known and validated. The main difference observable between human beings and other species is the ability to memorize, essential requirement to learn. Edgar Dale (1946, 1954 and 1969) provides a figure that shows the ability of human beings to retain and memorize, according to the activity involved (Figure 3).

Figure 2: Dual Theory of Systems: Reasoning and Justification



The dual model of cognition Stanovich & West (2000, 2003) indicate that in the human brain there are two ways of thinking and acting, a way of "autopilot", in which answers are spontaneous, immediate and effortless.

Figure 3: The cone of learning by Edgar Dale



Edgar cone Dole explained in a pyramid ease of memorization, from the weakest in the top of the pyramid (the reading), even more appropriate to store as videos methods, participate in workshops or perform a presentation. Passive activities are harder to remember, and the ability to memorize increases as will be more active activity. Source: Prepared by the authors based on Dale.

The strategy to be applied to achieve learning depends on each didactic unit. To start with an area or problem is something manageable, but it is possible that we need to deal with a lot of interrelated activities or problems. Individuals learn better when they interact with other individuals, including when that intervention is dramatized and with the exterior milieu in an *active attitude*, than with a passive attitude. With regard to *groups*: their learning ameliorates when each member cooperates to achieve common objectives and possess a common vision. The organization, as a global and integral system, learns by having feedback with the environment and manages to anticipate future changes.

METHODOLOGY

According to the characteristics of a work of theoretical research, the methodological path used is the collection of papers from psychologists who have worked on economic behavior and academic economics. They conduct research in behavioral economics, coupled to the classical theories the administration. It is essentially a descriptive work that tries to provide answers within the academic exploration of Latino culture to the concepts of learning organizations. While it is a qualitative research from the standpoint of the study of specific events, such events do not arise from the empyrean but are the product of observations of primitive work then developed through the filter of cultural vision and mental maps of the authors.

RESULTS

The human being is born in the bosom of a certain society having determinate customs absorbed since his birth. Customs are very strong, affecting the person for the rest of their life. A person receives a social, cultural and economic frame of reference that, like an iceberg, will stay secret, becoming manifest in certain situations or when required by an extraordinary event.

By means of socialization processes and formal and informal education the human adds models of troubleshooting, from S_1 to S_2 to give quick answers: almost always correct, to complex problems. Therefore, the interpretation of economic and social reality will substantiate the answer which will be duly justified by appropriate criteria, according to the type of rationality utilized.

The cycle of formal education begins with schooling, requiring effort of the intellect. For example, reading S_2 must actively participate to bring to mind a set of symbols and to initiate assembly of the puzzle of their conjunctions. This is when children begin to use words, but they do not understand or know what they have read because they have not yet passed to S_1 . The reading process and, therefore, according to Kahneman (2003) lacking the sufficient aptitude to realize two cognitive activities (requiring effort) simultaneously implies they are unable to understand what they read. Contents comprehension begins only when the reading procedure is transferred to S_1 and the child realizes this process without effort. We recognize an identical path for the following stages of schooling and contents of formal education and learning of jobs.

In the education process the formalization of behavior occurs and adequate tools are acquired leading to problem resolutions. Interpretation of reality takes the form of beliefs that support justified solutions in complex and unknown environments (Vieira Cano, 2008; Pascale & Pascale 2007; Estrada Gallego, 2006). Bounded rationality is a base for construction of decision making forms at any level (professor or student), slanted by their system of beliefs, values and principles, innate and acquired.

Cognition systems allow that use of new tools provided by ICT's to resolve difficult problems can be separated in two, in order not to exhaust the brain capacity. On one hand, resolution of simple mathematical schemes without major implications (stores in S_1) and, as a second process, incorporate the academic content through S_2 . This does not mean that the tool signifies an extraordinary use of the computational capacity defined by Simon.

The incorporation of simple schemes into the teaching process allows students to acquire concepts, according to their learning strategies. The use of new technologies is a must for teachers today and also the utilization of social networks to communicate with their students and to transmit teachings.

At high levels of education, students are instructed to work with models that have justification in programs according to their understanding of rationality, as stated by the standard model. The environment of excellence of academic cloisters facilitates beliefs in S_1 levels. This occurs when the force of imitation allows the application of complex models apprehended and lodged in S_1 to resolve other kind of problems. However, there are elements justifying their use, either due to the high notability or by its accessibility.

CONCLUDING COMMENTS

Universities are faced with the challenge of actualizing their methods, articulating their careers and promoting common actions between teachers and students as part of the challenges whose origin is the EEES (“Espacio Europeo de Educación Superior, European Space of Higher Education”). This space operates as a guide for American universities trying to be at the forefront of higher education.

The professor attitude must change. Today, access to knowledge is collaborative, not only among professors, but between students and teachers. Available resources continuously change. Chalk and blackboard seem to be things of a distant past. Today, teaching often occurs via WEB, often in the classroom with presence of the professor. The use of blogs and other tools are mandatory to move student on their way to the discovery of knowledge until the time of his graduation.

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