

MANAGEMENT LEARNING: AN ANALYTICAL APPROACH TO TEACHING METHODOLOGIES ASSOCIATED WITH COGNITIVE CAPABILITIES

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Abstract

The learning within the major universities in the entire world goes through a specific problem: the lack of effectiveness in the teaching-learning process. Thus, in order to develop theories and proposals to improve this process, as part of the management learning; this following article aims to develop a bibliographic analysis that associate teaching methodologies with cognitive capabilities, to create a structural map of teaching activities that guide the learning process in classroom, basing on student characteristics. From this, this study starts from the premise that the learning process should be used as a strategy for planning the teaching-learning process. Through a specific analysis of parsimonious character and theoretically grounded, it is understood a series of learning activities appropriate to cognitive abilities, so that proposed here a functionalist model of teaching and learning that seeks greater usefulness in the transfer of knowledge in classroom.

Keywords: Experiential Learning, Teaching methodology, Cognitive capability, Learning management, Bibliographical study

1. Introduction

The problem of learning process in the major universities in the entire world has been always in focus, because of the relevance of this process, as well as, because of primary goal of academy, that is the knowledge production with scientific bases. In this sense, the role of the educator is to be a guide of the learning process, so that they are characterized as agents of this process within the educational settings (Bordenave & Pereira, 1977; Libâneo, 1990; Luckesi et al., 2010).

This relationship between the professor and the student proposes that each of these is a factor in the development of learning, in which the professor is the “subject of creation, coordination, and proposition of studies, questions and discussions” (Luckesi et al., 2010, p. 43), being, in this case, the motivator of student to a high performance (Davis & Oliveira, 2010). And the student, moreover, is the agent of own learning (Kolb & Kolb, 2009).

The student is one who exercises his knowledge and can develop their potential and skills that come from individual efforts of assimilation and questioning, and thus, can create critical reflections, characterizing as a “psychological process in constriction” (Davis & Oliveira, 2010, p. 107). Thus, the student for learn, depends of cognitive, affective and motivational aspects, that propels him to the narrowing of information, adding up to environmental factors, and then, having a production of knowledge (Kolb, 1984; Luckesi, 1990; Harb et al., 1995).

Furthermore, it is understood that the professor is only a stimulator to the learning, in which the goal of this is to facilitate the transmission of information, practices and skills, impelling the students to feel up motivated to learn (Valente et al., 2008; Nogueira, 2009; Davis & Oliveira, 2010).

From this, Harb et al. (1995) propose that the learning process should be used as a strategy for planning the teaching-learning process. This perspective, according to Kolb et al. (2001) and Leng and Tin (2002), includes point that the students can come to learn more effectively if the method is compatible with your learning style – that is, their cognitive abilities.

Accordingly, based on the theoretical propositions raised here by leading academics in the field of education psychology and experiential learning, this following article aims to develop a bibliographic analysis that associate teaching methodologies with cognitive capabilities, to create a structural map of teaching activities that guide the learning process in classroom, basing on student characteristic.

2. Methodological Premises

This following study was undertaken through a bibliographic research, within a documentary approach of a literature specific about teaching-learning process. The bibliographic research, according to Gil (2012, p. 50), is made exclusively from documentary sources from literature, in which its main advantage “lies in the fact of allowing the researcher to cover a range of phenomena much broader than one that could search directly”.

Still, the deepening in a particular thematic, as well as the hypotheses delineation and the visualization of new research problems is guided in a series of reflective activities about dates available in the literature (Gil, 2012).

For Gil (2012), the steps to a literature search of documentary approach are:

1. Exploration of literary sources;
2. Selection of documents;
3. Selection of theories basis for the study;
4. Analysis and Discussion.

So, we follow the steps recommended by Gil (2012), in which the study could be divided into theoretical review and analytical discussion, to achieving the article objective.

3. Theoretical Review

3.1. Experiential learning for teaching questions

According to Souza, Milito and Pontes Jr. (2011), experiential learning is configured as a concept of great relevance in today's academic activity, because, in an environment where there is the need for constant improvement, experiential learning come emerging as facilitators in the process of adapting to changes, requiring from educational organizations some positions focused to the stimulus and motivation of their students.

Stimulate and motivate individuals to the learning, according to Souza, Milito and Pontes Jr. (2011), is to support the individuals, so that they become satisfied in contribute in generating ideas and even in the construction of knowledge. According to Minniti and Bygrave (2001), the learning process tends to develop by education and training, and also, by the sharing of knowledge and cognitive biological factors.

In this line of thought, Kolb, Rubin and McIntyre (1978) and Bransford, Brown and Cocking (2007) propose that experiential learning is a process that can occur of two modes: active and passive. When learning turns to the solution of problems, the learning process becomes more active, because the individual learns through experience and in a concrete mode.

Senge (2008, p. 32) reiterates this, saying that “all learning is related to the action”. And, when the learning process takes place through the transfer of knowledge between professor and student, the professor tends to guide the student, showing what he must learn, and the student accepts the propositions made by the teacher, making the learning a passive process (Kolb, Rubin & McIntyre, 1978; Boyatzis, Cowen & Kolb, 1995; Kolb & Kolb, 2009). The individual is induced to learn, and in this case, the problem that arises is the evaluation test proposed by the professor. In this sense, to learn becomes a necessity for the student (Bordenave & Pereira, 1977; Valente, Abib & Kusnik, 2007; Valente et al., 2008).

However, the problematic of education is in questions about the real learning of student, once that learning does not tend to occur only in passive mode (Libâneo, 1990; Bransford, Brown & Cocking, 2007; Senge, 2008). Then, we have: or the student learned or just memorized information in a mechanical process that will get lost in a given time. The efficiency of the teaching is in transform the information in knowledge, attitudes, skills and capacities themselves (Bordenave & Pereira, 1977; Libâneo, 1990; Bransford, Brown & Cocking, 2007).

Thus, the concern with the developing process of capacities, skills and competencies, it is relevant in order to create improvements in the transfer of knowledge when the individual is still in University (School, College etc.), and not when it is already inserted into the market work (Mainemelis & Boyatzis, 2000; Silva, 2004; Ruas et al., 2005; Valente, Abib & Kusnik, 2007).

It is also evident that the experiential learning, being focused on educational settings, is not only linked to the practice or transmission of theoretical knowledge (Kolb, Rubin and McIntyre, 1978; Mainemelis, Boyatzis & Kolb, 2002; Kolb & Kolb, 2009). Experiential learning emerge for create changes in the learning process, so that knowledge becomes practice and practice becomes knowledge (Kolb, 1984; Baker, Jensen & Kolb, 1997; Mainemelis & Boyatzis, 2000; Kolb et al., 2001; Mainemelis, Boyatzis & Kolb, 2002, Kolb & Kolb, 2009).

Thus, studies on this topic, pass to bring relevant contributions in a perspective of harmonizing the factors that make learning more effective (Mainemelis, Boyatzis & Kolb, 2002; Valente et al., 2008). Especially in educational settings that are linked to the passage of theoretical knowledge (Leng & Tin, 2002; Kolb & Kolb, 2009).

3.2. Learning

Theories of learning that have addressed the experience as the main factor of individual learning has coming of psychological approaches, possessing some allusions to pedagogical approaches. Can be considered

pioneers in the field of experiential learning, scholars such as Piaget, Vygotsky, Wallon, Dewey, Gagné, Skinner and Lewin. Such contributions constrict mental, social, environmental, motivational and cognitive factors (Wallon, 1951; Lewin, 1965; Bordenave & Pereira, 1977, Kolb, 1984; Vygotsky, 1984; Hinton, 1998; Swailes & Senior, 1999; Smith, 2001; Piaget, 2007; Pimentel, 2007), in a perspective that impels the whole learning to some type of experience (Kuethe 1978; Kolb, 1984; Pimentel, 2007).

3.2.1. Experiential Learning

The study of experiential learning has grown substantially since the late '70s. Several authors put this thematic in focus within the areas of organizational and educational psychology commonly in incentives to creativity and the acquisition of new skills derived from continuous learning (Kolb, Rubin & McIntyre, 1978; Boyatzis, Cowen & Kolb, 1995; Ruas et al., 2005; Souza, Milito & Pontes Jr., 2011). Furthermore, the study of experiential learning is based on the contributions of several authors that, despite different focuses, have foundation interrelated.

From the perspective of Henry Wallon (1951; 1973), which reflects on the problematic of education, the learning has relationship with the environment, so that the individual learns and develops through the environment in which it is. Now, in related to the more complex intellectual abilities, the individual needs of transfer of knowledge by the language and other means.

In another perspective, in which learning is deepened in psychological studies, there have been scholars such as Jean Piaget, which helped with learning concepts and perspectives of cognitive development, and points out that the individual learning evolves from concrete to abstract (Bordenave & Pereira, 1977; Swailes & Senior, 1999; Piaget, 2007; Pimentel, 2007).

John Dewey contributed with focus on the experience as the development of learning, emphasizing the nature of the exercise, through the principle of continuity of experience. In other words, the learning process continues while the individual to lives and confronts the various world situations (Kolb, 1984; Hinton, 1998; Swailes & Senior, 1999). “As an individual passes from one situation to another, his world, his environment, expands or contracts” (Dewey, 1938 *apud* Kolb, 1984, p. 27).

Kurt Lewin (1965), bringing the process of learning through dialogue, classifies the learning as a process of changes in cognitive structure of individual, and created a model consisting of a cycle of four stages. The Lewin's learning stages begin from the concrete experience, and then go on to undergo reflections and observations. Then, are formed the conceptions, generalizations and abstractions, and finally result into a test environment of

acquired concepts. Kolb (1984) argues that the model of Dewey's experiential learning is similar to Lewin's model.

Philosopher and psychologist, Vygotsky (1984) contributed to the learning theories focused on historical and cultural and socio-historical factors. Vygotsky (1984) also proposed highly relevant relationships between the individual that learns and the individual that teaches; in a perspective that learning is an ongoing process that starts from the birth of the individual.

According to Brookfield (1983), researchers in the area of experiential learning have used two perspectives on the topic. In the first perspective, studies depart for the type of learning in the classroom, in order to produce knowledge and acquire skills. This view of learning is linked to the process of teaching and learning developed in educational institutions.

The second perspective on experiential learning, studies have departed for the type of learning within the individual's daily life, which involves learning through reflections, socio-cultural and sensory experiences. This type of learning tends to occur indirectly and spontaneous (Brookfield, 1983).

Another theory categorizes experiential learning in four focus (or villages), and brings the most classic concepts to the forefront, in which it has as direction to theory of the primary learning, in which it discusses the problem of learning from own experience (Weil & McGill, 1989).

In the first village, the studies generally focus on the assessment of learning, and on the learning that comes from life and work experiences. In the second village, there is experiential learning as a basis for creating structural changes in post-school education. The third village, the emphasis is on experiential learning as a basis for the construction of group consciousness, namely, learning related to interpersonal relationships. The fourth village is related experiential learning with self-consciousness of the human being and personal growth of him (Weil & McGill, 1989).

Despite of the various theories of experiential learning, according to Smith (2001, p. 1), is the theory of David Kolb which has the best "central reference point for discussion". According to the author also, there is an increased of academic productions related to experiential learning, after the emergence of the Kolb's theory (Smith, 2001).

3.2.2. David Kolb's theory of Experiential Learning

The David Kolb's theory of experiential learning, proposed in the book "**Experiential learning: experience as the source of learning and development**" (Kolb, 1984) which also uses the psychological approach was based on the elemental form in the three authors cited above (which focus in the experimental psychology and experiential learning), Piaget, Dewey and

Lewin, comprising various contributions of these scholars in Kolb's theory (Kolb, 1984; Hinton, 1998; Swailes & Senior, 1999). Kolb's theory also makes allusions to the principles and concepts of the learning theories of Lev Vygotsky (Pimentel, 2007). Pimentel (2007, p. 160) states that "the Kolb's theory has in historical-cultural postulate (Vygotsky and followers) a source of inspiration".

Kolb's theory contributed to the visualization of learning in other perspectives, as the focus in the area of management, entrepreneurship and intra-entrepreneurship (Mainemelis, Boyatzis & Kolb, 2002; Corbett, 2005; Souza, Milito & Pontes Jr., 2011). Also, Kolb's theory has been studied in other areas as Marketing by Petkus Jr. (2000), training in organizations by Larsen (2004), and human resource development by Yang (2004), and in undergraduate courses, such as engineering by Cury (2000), technology by Trevelin and Belhot (2006), psychology by Pimentel (2007), accounting by Valente, Abib and Kusnik (2007) and in social communication and media by Valente et al. (2008). According to Boyatzis, Cowen and Kolb (1995) and Smith (2001), Kolb's theory tends to have better use in the higher education, especially in universities.

The experiential learning theory developed by David Kolb is also known as "learning by action" (Baker, Jensen & Kolb, 1997; Marsick & O'Neil, 1999), and became a strong base for studies that aimed identify a specific learning mode to a particular individual or group of individuals (Mainemelis, Boyatzis & Kolb, 2002; Valente, Abib & Kusnik, 2007; Valente et al., 2008; Kolb & Kolb, 2009). Point out the learn characteristics of people, can provide to educators (professors), information to guide teaching strategies that are appropriate to learning modes of the individual (Belhot, 1997; Cerqueira, 2000; Valente, Abib & Kusnik, 2007; Kolb & Kolb, 2009; Souza, Milito & Pontes Jr., 2011).

Thus, it is evident that this literature comes facilitate the studies of experiential learning in several environments: educational, social and organizational, among others. Especially to contribute to the improvement of teaching techniques within the educational settings (Acharya, 2002; Adu-Febiri, 2002; Boyatzis & Mainemelis, 2000; Valente, Abib & Kusnik, 2007; Kolb & Kolb, 2009; Souza, Milito & Pontes Jr., 2011).

3.2.3. Kolb's Theory

The definition proposed by Kolb (1984) for experiential learning follows the thought line of other authors and scholars on the area, in which has the focus in experience as basis for the learning. The author defined experiential learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb, 1984, p. 41).

According to Kolb (1984), the definition proposed by him, highlights many aspects of learning that comes from an experimental perspective, in which he argues, scoring four points in his theory.

First is the emphasis on the process of adaptation and learning as opposed to content or outcomes. Second is that knowledge is a transformation process, being continuously created and recreated, not an independent entity to be acquired or transmitted. Third, learning transforms experience in both its objective and subjective forms. Finally, to understand learning, we must understand the nature of knowledge, and vice versa (Kolb, 1984, p. 38).

Based on these knowledge, Kolb (1984) brought foundations for experiential learning that might give a direction for future studies on the topic and explain the behavior of human learning, and as a consequence, the contribution to the resolution of problems of learning. This learning model proposes that learning requires opposite skills, and that the individual will choose which skills he will use in a particular learning process.

Some individuals get experience through the perception of a concrete situation, from the lived reality. Other individuals understand new situations in their daily lives, through analysis, thoughts, or even systemic planning, instead of using their own experiences (Mainemelis, Boyatzis & Kolb, 2002). In this same way, we can see that in the processing (transformation) of the experience, some individuals tend to observe and reflect on the experience of other individuals who are experiencing, while others prefer to experience the situations by themselves (Kolb, 1984; Kolb, Boyatzis & Mainemelis, 2001).

“Each dimension of the learning process presents us with a choice” (Kolb, Boyatzis & Mainemelis, 2001, p. 4). According to Kolb (1984), being natural of human have their own life experiences and in own environment, the individual develops itself the best way to choose. The individual tends to resolve conflicts to choose formats to learn, concrete or abstract mode, or active or reflective (passive) mode. These characteristics are standardized in some individuals and are defined as **Learning Modes**.

In this perspective, the model developed by Kolb (1984), demonstrate a learning circle, or learning cycle, which can be viewed as the central focus of his theory of experiential learning, providing the understanding of learning modes, different in each one, which adapts to all people.

Kolb, Boyatzis & Mainemelis (2001) and Mainemelis, Boyatzis & Kolb (2002) claim that this learning circle represents a spiral in which the student touches all the bases; and, that the student will starts the learning cycle on the base that him feel more comfortable.

For identifying learning modes of individuals, Kolb (1999) developed the Inventory of Learning Styles (ILS). This inventory was developed in

early of their research on experiential learning, in which, one realizes that this instrument has undergone a lot of changes. Such changes can be viewed as highly relevant, and were designed to improve the instrument, to get closer to the reality of the individual.

One of the first Inventories of learning styles developed by Kolb is in the book “**Organizational psychology: An experiential approach**” (Kolb, Rubin & McIntyre, 1978). Could be visualized in this Inventory some primitive points, which can be understood as weaknesses, especially in view of the coverage of this psychological test.

Thus, during the evolution of the Inventory of Learning Styles (ILS), were made more psychological issues, proposing learning linked to cognitive factors, while the old Inventory was more connected to personal interpretation, focusing mainly on organizational learning.

It is possible to discuss the use of both two specific inventories. The first Inventory (Kolb, Rubin & McIntyre, 1978) focuses the application on organizational environments, in particular, because this Inventory was developed for use in enterprises, generating a more immediate answers; and, the second Inventory (Kolb, 1999) focuses on the application in academic settings, because this Inventory have more complex features.

Souza, Milito and Pontes Jr. (2011) also discuss the fact that the application of the second Inventory (more complex) led to problems regarding to the understanding of the instrument questions by individuals (which were of low education) who participated of their research, which reinforces the idea that you can make better use of the Inventory of Learning Styles (IEA) in higher education (universities).

3.2.4. Learning Modes

The learning model developed by Kolb and colleagues (Kolb & Fry, 1975; Kolb, Rubin e McIntyre, 1978; Kolb, 1984; 1999; Kolb, Boyatzis & Mainemelis, 2001; Kolb & Kolb, 2009) encompassed a number of theories that have standardized the way that individuals learn. This theory exposes a standardization that it applies to any individual.

Kolb and Fry (1975), Kolb, Rubin and McIntyre (1978) and Kolb (1984) propose that learning always takes place in four stages. The four stages of learning, also called phases, indicate the learning mode of individual. The individual tends to experience all stages of learning, so that it becomes a cycle. The learning modes of this cycle are described by Concrete Experience, Reflective Observation, Abstract Conceptualization and Active Experimentation.

According to Mainemelis, Boyatzis and Kolb (2002) and Corbett (2005), the learning cycle can be understood as a training cycle, in which

each individual has a learning mode own, related to what is learned, how is learned, and the situations experienced by the individual in daily life.

This learning cycle must be treated as a process based only on experience. The four stages of the cycle are divided into two points, which conceptualize learning modes: how obtain experience (comprising), which is characterized by learning modes: Concrete Experience and Abstract Conceptualization. And, how handle with the experience (doing), which is characterized by learning modes: Reflective Observation and Active Experimentation (Figure 1) (Kolb, 1984; 1999a; Kolb, Boyatzis & Mainemelis, 2001; Mainemelis, Boyatzis & Kolb, 2002; Kolb & Kolb, 2009).

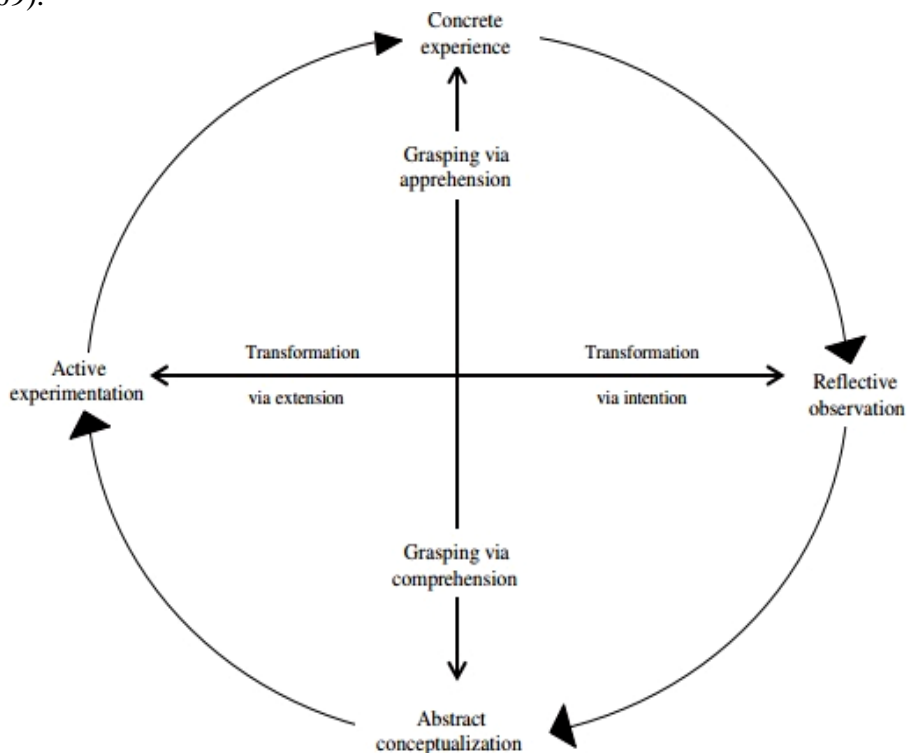


Figure 1. Learning Circle
Source: Corbett (2005, p. 480).

The learning cycle in the person may come to begin in any of the four learning stages. This is a cycle of experience (apprehension), reflection (intention), thought (comprehension) and activity (extension), in which, the best use of learning will give when the individual goes through four learning stages (Kolb, 1984, 1999; Kolb, Boyatzis & Mainemelis, 2001; Corbett, 2005).

Thus, when the individual starts to learn, he will choose the most comfortable learning mode, and the cycle begins. If the individual begin the

learning process through Active Experimentation, doing, he will feel what was produced and perform own feedback. Thus, this individual will continue the cycle, creating generalizations about the experience. He will idealize concrete connections between what learning acquired, and then will be the next stage of the cycle, the Concrete Experience (Kolb, 1984; 1999; Mainemelis, Boyatzis & Kolb, 2002; Corbett, 2005; Kolb & Kolb, 2005; Souza, Milito & Pontes Jr., 2011).

The four learning modes, according to Kolb (1984, 1999) are defined by the following characteristics:

– **Concrete Experience:** The individual that learns through Concrete Experience is involved with the practical situations. This individual learning, basing on situations already lived and similar to the corresponding situations, executing the knowledge gained. In this perspective, he improves up each time that he participates of a new situation. This learning mode comes from a number of relationships and exchanges of information between individuals, in which experience is the factor of greatest importance in the learning process.

– **Reflective Observation:** The individual that learns through Reflective Observation is careful to observe carefully all situations. Thus, this individual comes to reflect from different angles its question or problem of study, or a situation which he lives. The purpose of the individual in Reflective Observation is to collect information, focusing in correlation between the information collected and the facts that have been or will be submitted to the daily lives of him.

– **Abstract Conceptualization:** The individual that learns through Abstract Conceptualization produces concepts with based on rationales issues. The goal of the individual is to find the best analysis for the situations. This individual can generate hypotheses to form logical perspectives on situations that he lives, in order to acquire better knowledge to their own experiences.

– **Active Experimentation:** The individual that learns through Active Experimentation tends to execute the knowledge that was acquired in practical experiences. This individual will develop theoretical reflections with the intention of using them in new situations that he will experiment. It is through theoretical foundation developed by this individual, which he even will feel encouraged to use the acquired knowledge and to make the right attitude, especially in solving of problem and in making decision.

These learning modes proposed that learning will occurs through the individual choices for a particular learning mode. Perceives so, that the learning mode of the individual is related to its sensory and emotional response to the experience, in which, motivational factors have high power interference in learning (Kolb, 1984; Corbett, 2005; Kolb & Kolb, 2009).

Thus, in a teaching-learning process, interpret the way individuals learn is relevant to emphasize teaching methods in the learning mode preferred, and thus create an environment more comfortable to learning, motivating the student (Leng & Tin, 2002; Valente, Abib & Kusnik, 2007; Valente *et al.*, 2008; Souza, Milito & Pontes Jr., 2011).

3.3. Teaching-Learning Process

The teaching dynamics, especially in formal learning environments, almost always is set by pre-establish models of teaching methods, in which the goal also is merely the transmission of knowledge (Bordenave & Pereira, 1977). This transmission of knowledge, at the present, is linked to the rapid technological development and globalization (communication speed), and has been characterized as a “[...] just consumer and repeater of information that are imported to “professionalize” [...]” (Luckesi *et al.* 2010, p. 29). In other words, education is like a catalyst for learning, such as a transmitter of “canned” information (Luckesi *et al.*, 2010).

In this sense, becomes fragmented the teaching characteristic of giving to the student the ability to use which is learned in the classroom in other contexts, such as the workplace; Because the transfer of knowledge can be viewed as a broad process of instruction and education of the student, and not only exposure of information and within the educational settings (Bransford, Brown & Cocking, 2007).

This teaching characteristic, according Kuethe (1978) proposes that education is a process, and learning is the product of this process. It can be seen that the conclusion of the teaching process will result in learning. In other words, in the teaching process, when there is no learning, there is no education.

Such perspectives propose that there is a professor (an educator) as a figure motor of this process. Although, learning is not only occasioned by teaching process, but also through environmental, motivational and cognitive factors (Sawrey & Telford, 1971; Kolb & Fry, 1975; Kolb, 1984; Boyatzis, Cowen & Kolb, 1995).

3.4. Management Learning

The literature has pointed that the need for management learning within the teaching setting is important in order to increase the productivity of classes in undergraduate courses (Bordenave & Pereira, 1977; Ruas *et al.*, 2005; Valente, Abib & Kusnik, 2007; Valente *et al.*, 2008).

Therefore, the learning becomes the moment which there is the union of the structural knowledge and the experience, resulting in the generation of professional development (Boyatzis, Cowen & Kolb, 1995; Mainemelis,

Boyatzis & Kolb, 2002; Ruas *et al.*, 2005; Bransford, Brown & Cocking, 2007).

In this perspective, the relationship of the teaching methods used by professors with the way students learn, tends to increase the efficiency of the skills and knowledge imparted, or decrease, if there is no compatibility between these (Bordenave & Pereira, 1977; Kuethe, 1978; Boyatzis, Cowen & Kolb, 1995; Acharya, 2002; Jacobsohn, 2003; Valente *et al.*, 2008).

In this sense, manage learning within the education setting is to make students become more inclined to learn. Thus, it is relevant to understand how professors promote learning in the transfer of knowledge in this environment of education (Valente *et al.*, 2008; Souza, Milito & Pontes Jr., 2011).

Smith (2001) reiterates that the educator may increase the efficiency of your classes, if he is able to use the learning modes of students as base. For this, he needs to create an ambiance in the classroom that is more appropriate to the students, so that they have effective learning, requiring some specific analysis between the teaching methods of professors and the cognitive aspects of students.

4. Analytical Axis: Teaching activities X Cognitive capabilities

Teaching methods, in general, are determined by an orientation towards the achievement of specific goals. These goals induce the professor to create systematic models of activities, actions, steps and procedures that require the use of means. The means depend on the methodological design of the educational process, including the type of information and skills that will be passed to students (Libâneo, 1990). According to Libâneo (1990, p. 151), teaching method is a “process of transmission and active assimilation of knowledge and skills”, in which individuals that learn should be prepared for the reality, using the knowledge obtained.

However, the teaching methods used by professors in higher education institutions have been considered repetitive, being the lecture (oral exposition), the most common method used by professors (Bordenave & Pereira, 1977). Bordenave and Pereira (1977) point out that many professors were immersed in the educational practice without pedagogical training. The key point, in fact, for many authors (e.g., Bordenave & Pereira, 1977; Kuethe, 1978; Libâneo, 1990; Luckesi *et al.*, 2010; Senge, 2009), is linked on the need of the student to participate actively in the learning process.

Although the literature comes pointing for the use of methods that will increasingly involve the student actively, Bordenave and Pereira (1977) point out that all teaching methods have limitations that involving the professor competences and also the inadequacy of the student's learning modes.

Many authors of pedagogical context discuss concepts, theories, typologies and definitions for teaching methods. In the following study, was used as a basis for pedagogical discussion, authors like Bordenave and Pereira (1977), Kuethe (1978), Libâneo (1990) and Luckesi *et al.* (2010). These authors propose a number of teaching methods that depart from similar fundamentals quite.

From this, the theoretical model of Bordenave and Pereira (1977) for teaching methods is better adapted to the learning modes, because are related to characteristics of the learning stages. The authors indicate that, given the scope of teaching methods, the best teaching style is to develop activities, and not specific teaching techniques. Develop activities means creating a series of operations that are focused on the cognitive capabilities of students.

Leng and Tin (2002) corroborate this thought line, and assume that every subject, theme, or even teaching skills of professor is intrinsic to the problematic of education, and thus the teaching techniques must be linked to student's learning modes.

This theory assumes the premise of to guide the teaching basing on the learning. This theory assumes a format that includes cognitive capabilities of students, and thus may be indicated activities that are more similar to those capabilities (Bordenave & Pereira, 1977).

Bordenave and Pereira (1977) classify the educational activities in five types of cognitive capabilities, which may suit to the experiential learning model from Kolb (1984). As can be seen below, the theoretical model of Bordenave and Pereira (1977).

1. Cognitive capability of **Observe**: involves the perception of reality and the description of situations in order to acquire knowledge by processing of information. The main activities that run this kind of capability are:
 - Excursion and visits;
 - Diagnostic techniques;
 - Lectures, conferences and expositive classes;
 - Seminars, symposia and panels;
 - Audiovisual aids.
2. Cognitive capability of **Analyze**: involves the decomposition of objects or systems in small parts in order to build relationships, parameters, and discriminate the problems, so that there is a process for identifying constituent parts. The main activities that run this kind of capability are:
 - Diagnostic of situations;
 - Case studies;
 - Discussion focused;
 - View of schematics, diagrams and charts;
 - Demonstration of methods.

3. Cognitive capability of **Theorizing**: involves the construction of knowledge models, which are added through inferences, generalizations and critical thoughts about reality, in order to develop concepts and propositions, so that to interpret this knowledge obtained in everyday life. The main activities that run this kind of capability are:
 - Literature research
 - Development of critical reviews;
 - Individual reflection based on reading scientific texts;
 - Research projects;
 - Contact with researchers and scholars.
4. Cognitive capability of **Summarize**: involves operations of judgment, evaluation and discussion of values, in order to solve problems through decision making. The main activities that run this kind of capability are:
 - Troubleshooting;
 - Writing reviews;
 - Oral exposition of troubleshooting in the short term;
 - Fieldwork;
 - Brainstorming (ideas production).
5. Cognitive capability of **Apply** and **Transfer** the knowledge: involves operations of planning, organizing, conducting, execution and production, which aims to guide situations and build propositions that transform knowledge into practice. The main activities that run this kind of capability are:
 - Application of methods;
 - Delegate tasks to students;
 - Simulation of situations;
 - Internships directed;
 - Evaluate real situations.

These activities are only suggestions, which according Bordenave and Pereira (1977), should be added viably in the style of professor, and not be treated as irrefutable rules. Such teaching activities tend to combine, in a way that several kind of activity should be used at the same time.

According Bordenave and Pereira (1977), the combination of these activities may have two dimensions. The first dimension is horizontal or simultaneous complementarity, in other words, are activities that are part of the same cognitive ability, which may ultimately give the student an opportunity to better fit to the teaching method. The second dimension is a complementary longitudinal or sequential, in other words, are activities to different cognitive capabilities, but that can give to the student a view of a situation or issue by different means at the same time. These dimensions do

not contribute “only to enrich the learning, but also for the retention of that was learned” (Bordenave & Pereira, 1977, p. 132).

In this perspective, one can create relationships between learning modes and teaching activities, to identify models that can take best results in student learning, and increase the effectiveness of lessons in learning environments, which is highly linked to the proposal of the following study, that has aimed to create good relationships between teaching and learning, to give better results in the classroom (Leng & Tin, 2002; Souza, Milito & Pontes Jr., 2011).

Thus, it is indicated in the following diagrams the relational schema of cognitive capabilities (Bordenave & Pereira, 1977) with the learning modes (Kolb, 1984) (Table 1).

Table 1: Relational schema of Cognitive Capabilities with the Learning Modes

Id	Cognitive Capabilities	Level	Learning Modes
1	Observe	1A	Reflective Observation (RO)
		1B	Active Experimentation (AE)
2	Analyze	2A	Abstract Conceptualization (AC)
		2B	Reflective Observation (RO)
3	Theorizing	3A	Abstract Conceptualization (AC)
		3B	Active Experimentation (AE)
4	Summarize	4A	Concrete Experience (CE)
		4B	Abstract Conceptualization (AC)
5	Apply and Transfer	5A	Active Experimentation (AE)
		5B	Concrete Experience (CE)

Source: Developed by Authors.

In Table 1, we analyze that the learning modes in foreground [**1A, 2A, 3A, 4A, 5A**] that are in the framework above are most suitable to the corresponding cognitive capability. Thus, when student has a learning mode of Active Experimentation [**5A**], for example, this student will tends to prefer to use cognitive capabilities of **Apply and Transfer**. If the student has a learning mode of Abstract Conceptualization [**2A** and **3A**] this student will tends to prefer to use cognitive abilities **Analyze** and **Theorizing**.

On the other hand, the learning modes in the background [**1B, 2B, 3B, 4B, 5B**] those are in the framework down, means also that are suited to the corresponding cognitive abilities, but are not preferred by the individual. Thus, a student's learning mode of Active Experimentation [**1B** and **3B**] has like cognitive capability secondary **Observe** and **Theorizing**.

5. Theoretical Model

The following study was through of a relational analysis between the theories of teaching activities from Bordenave and Pereira (1977) and Learning Modes from Kolb (1984), because it was understood that this

combination of theories best fit to the model proposed of learning in higher education (universities), especially relating to the resolution of problems.

The intention was to create a net between theories of Bordenave and Pereira (1977) and Kolb (1984), in order to related them, to create a parameter to the students understand what learning activity that best fits to the their learning mode, and for the professors comprise what techniques should be used for each learning mode.

From this, our theoretical model proposed here shows a net that associates Modes Learning, Cognitive Capabilities and Teaching Activities. In this sense, each learning mode has compatible cognitive capabilities, which is related to specific teaching activities, as can be seen in Table 2.

Table 2: Theoretical model of Teaching Activities associated with Cognitive Capabilities of Learning Modes

Learning Mode	Cognitive capabilities	Teaching activities
Concrete Experience	Summarize	Troubleshooting / Writing reviews / Oral exposition of troubleshooting in the short term / Fieldwork / Brainstorming (ideas production).
	Apply and Transfer	Application of methods / Delegate tasks to students / Simulation of situations / Internships directed / Evaluate real situations.
Reflective Observation	Observe	Visits / Diagnostic techniques / Lectures / Expository classes with audiovisual aids.
	Analyze	Case Studies / Focused discussion / View schematics, diagrams and charts / Methods demonstration.
Abstract Conceptualization	Theorizing	Literature research / Development of critical reviews / Individual reflection based on reading scientific texts / Research projects / Contact with researchers and scholars.
	Summarize	Troubleshooting / Writing reviews / Oral exposition of troubleshooting in the short term / Fieldwork / Brainstorming (ideas production).
	Analyze	Case Studies / Focused discussion / View schematics, diagrams and charts / Methods demonstration.
Active Experimentation	Apply and Transfer	Application of methods / Delegate tasks to students / Simulation of situations / Internships directed / Evaluate real situations.
	Observe	Visits / Diagnostic techniques / Lectures / Expository classes with audiovisual aids.
	Theorizing	Literature research / Development of critical reviews / Individual reflection based on reading scientific texts / Research projects / Contact with researchers and scholars.

Source: Developed by Authors.

Therefore, for example, an individual which owns the Learning Mode of Reflective Observation has cognitive abilities of **Observe** and **Analyze**. These capabilities, in turn, involve teaching activities as: Visits; Diagnostic

techniques; Lectures; Expository classes with audiovisual aids; Case Studies; Focused discussion; View schematics, diagrams and charts; and, Methods demonstration.

6. Final considerations

Aiming to develop a bibliographic analysis that associate teaching methodologies with cognitive capabilities, our study created a theoretical model specific of learning activities that suit the cognitive abilities of an individual. This means that in future the studies about the teaching-learning process will can have a new basis for a fruitful determination of teaching methods that are more profitable for their students. In this regard, we emphasize that it is necessary to use the model of Kolb's experiential learning [Inventory of Learning Styles (ILS) (Kolb, 1999)], to that it is possible to do the use of the theoretical and empirical propositions presented in this study.

Thus, in order to deepen the themes raised here, we consider important that other researchers study some issues, such as: (1) Attitudes and emotions of students about teaching methods, and relate it to their ways of learning, (2) Learning versus context of student, (3) skill versus knowledge of the process, through better education, and (4) the relationship between the learning modes and academic performance.

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