Education by Technological Intervals in Higher Education: TIHE Model

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Abstract — **The accelerated changes in society and the advances in Information and Communication Technologies (ICTs), while posing great challenges, offer enormous potential for transforming education. ICTs, in some countries has influenced and changed Higher Education. However, one of the features of this new methodology using ICTs to work in class, is mixing the traditional learning process with the virtual education in which students can search information on internet related with the topic that are studying during the class. This can motivates students and can result in a more efficient learning process. Many researches, especially with the constructivist paradigm in learning process, emphasize learning as an internal process, carried out by those who learn by themselves, as an active process of knowledge construction, which cannot be acquired passively. That is why the objective of the article is to propose a model for learning environments using technologies that guarantee the motivation and experimentation of a student of Higher Education.**

Keywords - ICTs; Higher Education; Knowledge construction; TIHE Model.

I. INTRODUCTION

With the development of technology, the board, books and texts are insufficient for generations born in the digital age. Innovations in technology allow greater interactivity and better learning in minds that have grown with many stimuli and who constantly use technology in their lives [1]. Keeping students for 60 minutes in a class without any access to the technology can result in lack of attention and demotivation, contributing significantly to school dropout.

The greatest resources of learning are the student and the teacher, a class is only possible as collaboration between these two parties. Without the students' participation in the activities proposed by the teacher, the class will not go forward; and if the teacher does not accept the opinions of the students and be irreducible in their methodologies, the class will not go forward either; and thus, teacher and student become apathetic with each other and do not think of this relationship as an alliance but rather as conflicting [2].

In this context, technology can strengthen these connections if it is used in an appropriate and innovative way, allowing the students to actively contribute to a more productive class, and thus helping the teacher to also immerse in digitality [3].

In this scenario arises the concept of flipped classroom. These change is mainly methodological, and it is necessary that the content is carefully planned for this purpose, because it will be up to the student to study the content, while the moment of interactions with the teachers, whether distance or face-to-face, will be focused on the practices. This means that the activities and applications that the student used to do at home are now made in the classroom, either face-to-face or virtual, with the teacher's mediation [4].

Technological tools in the educational field, include several methods and means of work given by the teachers, in which, the impact of the learning in the integral formation of the university students, are oriented to the creation of learning environments and, developed for the shortage of technological culture since the universalization allows carrying out the process of multifunctional training for the stimulus of greater cooperative learning [5].

Virtual education is a strategy that uses computer and computational tools to support and modernize a very old activity, the process of teaching and learning, which is a process that today can be enriched with more effective instruments that allow students to work more independently and with rhythms according to their abilities and possibilities [6]. There are many benefits that virtual education has. For example, increase critical thinking skills to solve practical problems; implements decentralized learning where teachers and students, located in different geographical locations but connected by the intranet or Internet, are available in current time; learning can occur regardless of time and place; the student can advance, retreat or deepen information according to their own level of achievement or the nature of learning projects; through virtual simulations students and teachers can achieve experimental learning and it is multicultural because people from different cultures usually come together.

Different theories about learning process can be used to create a model, in which, the learning-process can applied in a different way, supported with technology. Some of these theories are; theory of Gestalt, sociocultural theory, multiple intelligence and constructivist theory. They include features of neuroscience, psychology and education. For example, one of these points out that intelligence is a way to act through the mental ability, more stimulus create better learning, more use of online networks improves mental ability and learn to learn

process. The purpose of the article is to propose a model for learning environments using technologies that guarantee the motivation and experimentation of a student of Higher Education. This is called Technological Intervals in Higher Education model (TIHE Model).

The paper is structured as follows; the 2nd section describes different theories about learning process, which allow technologies to be one of the main factors to transform education. The 3th section, presents the model proposed which is focused on technological intervals in Higher Education. Finally, the 4th section concludes the paper and gives insights for future researches.

II. BACKGROUND

A. Gestalt Theory

The starting point of Gestalt theory about learning is that, what are stored in the memory are traces of perceptual stories, and the organizational laws govern the structure of perceptions [7]. It also determines the structure of the information that is established in the memory in the case of learning by trial and error, in which the learner faces some problem. Gestalt theory gives great importance to the way in which the subject structures or sees the problematic situation. Thus, the ease or difficulty of a problem is largely a matter of perception [8].

For this theory, the synergy generated by systems, in this case the educational system with a virtual class and the information and communication systems, when the student learns in a virtual environment is more than the sum of its parts. This is justified in first place by the coverage of the information that compose the thematic contents of the virtual space, which are extended with immense possibilities of consulting distributed information databases, virtual training spaces, parallel to the environment where the student learns and links through which they can navigate within the network to expand information. In addition, the Gestalt theory applied to the operation of interfaces in virtual training processes, makes the graphic designs of a virtual course in its contents of texts, dynamic images and integrated sounds, shown by the platform to the student, a powerful tool to enable greater learning [9].

B. Sociocultural Theory

For Vygotsky, the social context influences learning process more than attitudes and beliefs. It has a profound influence on how and what a person thinks. Context is part of the development process and, as such, shapes cognitive processes. In this sense, the social context must be considered at various levels [10]. First, the immediate interactive level constituted by the individuals with whom they interact in some moments. Second, the structural level constituted by the social structures that influence a person, such as family and school. Third, general cultural or social level, constituted by language, numerical systems and technology [11].

The psychology of Vygotsky ponders the activity of the subject, and this is not specific to respond to stimuli, but uses its activity to transform him. It means that in order to arrive at the modification of the stimuli, the subject uses mediating instruments. One of these instruments is culture that provides the necessary tools to modify the environment. In addition, since culture consists mainly of signs or symbols, they act as mediators of the actions as well.

For this theory learning environments should be a place where students work together, helping each other, using a variety of tools and resources that allow achieving learning objectives and problem-solving activities. Thus, it is fundamental within collaborative environments the use of technological tools due to; 1) interacting with the community is vital; 2) the student is not considered an isolated entity, therefore the teacher must favor the interaction and joint solution of problems creating social spaces; 3) The creation of learning communities is facilitated by the use of tools that facilitate the exchange of information, access to shared resources and documents among several members of a community.

C. Multiple intelligences theory

Another theory that supports a technological model is the multiple intelligence theory, which has shown how human beings learn in very diverse ways, insofar as there is not a single intelligence but multiple and diverse types of intelligences (Gardner, 1983) [12]. For example, for some people the verbal and linguistic plays a central role, but for others, on the other hand, body language is the most important thing. The first type of people, learn mainly by listening, speaking, reading and writing. The second ones learn especially by touching, moving and experimenting. From this set of concepts about learning, can be deduced, at least, two other issues related to behavioral models, focused on stimulus and effect [13]. On the one hand, one issue is the questioning of standardization, in which, the apprenticeships are always personal constructions that must start from the previous knowledge of the learners. On the other hand, it does not seem possible to build a single program valid for any group and any person, armed in advance without knowing the specific situation of the learners or their specific ways of learning.

D. Constructivist theory.

Constructivism considers the role of the student or subject that learns. The cognitive subject plays an active role in the knowledge process. This knowledge is not a copy of the world at all, but is the result of a construction on the part of the subject, insofar as it interacts with the objects. The starting point of all learning is prior knowledge, which is the result of learning that occurs when what the student knows with what they should know comes into conflict [14].

In this sense, in the constructivist model, the teacher must be a promoter of activities allowing students to explore and solve problems, involving technological tools in enriched contexts. Here, the fundamental role of the teacher is to be a guide to follow.

III. TECHNOLOGICAL INTERVAL EDUCATION IN HIGHER EDUCATION MODEL

A. TIHE styles

In the proposed model, the TIHE model (Fig.2), there are some important styles that have to be considered:

(1) Styles of individual and group orientation for reproductive intervals.

In this sense, direct orientation between teacher - student is generated by the constant and increasing stimulus of the interval that gets a positive reaction. Induced practice, that is a scheme that generates group or individual participation in a topic worked at technological intervals. The inclusion of technology gives the induction of participatory work. Finally, self-evaluation that is the reproduction of knowledge developed and conversed in an autonomous way.

(2) Styles of reproductive orientation by guided intervals.

For the second style of orientation, guided discovery is an action carried out by intervals of questions that develop the constructivist educational logic of new ideas and paradigm ruptures. Then, comes the divergent thinking that is the development of dynamic and active creativity during classes with a prolonged period of time. Individual programming also develop the programmed metacognition for the specific teaching process.

(3) Direct control style

In this style, the teacher is the facilitator and enhancer of the activities generated in each class. The teacher plays a role of facilitator and the student executes what is planned in the class. Teacher also uses and optimizes the time, through intervals which have as a purpose the immediate response, the uniformity and the efficient and effective synchronized execution of activities, capable of occupying up to 15% the use of the memory of each student. In this sense, the technological channels allow generating compression in bigger scale and efficiency in the use of the time (active mind).

(4) Practical style based on the development of tasks by intervals.

On the one hand, feedback is essential through dialogue oriented in the experimental discussion. On the other hand, the introduction of development of tasks in the decision making generated by the orientations in each class, enhance cognition.

B. Areas of teaching styles by technological intervals

The teacher guides all educational processes through the use of participatory technology generating pragmatic alternatives of positive impact, which are aimed at stimulating the growing called meaningful learning channels. For the styles of teaching by technological intervals some areas are included.

Neuroscience, that is the set of scientific disciplines that study the nervous system, in order to approach the understanding of the mechanisms that regulate the control of nervous reactions and the behavior of the brain [15].

Neuro-education deals with the junction of the knowledge of psychology, education and neuroscience (Fig.1).

Psychology, one of the areas that has always supported education, has added new knowledge to neuroscience, and has begun to bring differentiated approaches to the educational context and, therefore, pedagogy based on education and learning has realized that a new educational approach was necessary, to return to the origins and to regard the human being as a global being. All the areas that until then were "specialized in" are modified and begin to act in an interdisciplinary way adding the nomenclature of neuro-education [15], [16].

Neuro-education for its part brings us a differentiated approach for learning. Previously, in a more traditional view the learning process is the acquisition of new knowledge; in the case of neuro-education shows that learning is changing behavior. As far as neuroscience is concerned in education, there is nowadays evidence that a balanced and motivating learning environment requires students to learn better [17].

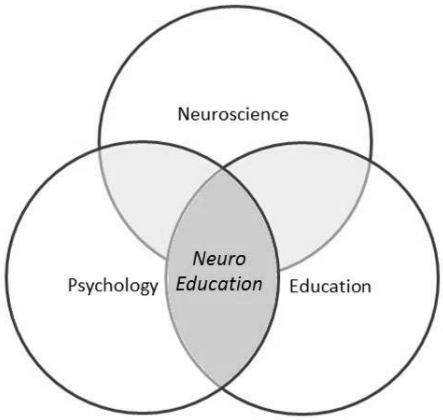

Figure 1. Neuroeducation knowledge areas.

In this context, the use of optimal time can be described within the process, which means technological neuro-education enhanced by educational implications with greater neuronal activity in each of the classes called spatial memory, which is capable of recording information on the ascending scale of the brain [17].

C. Methodological significance of the technological model by intervals in Higher Education

The TIHE model is a dynamic and flexible structure oriented to the information of contents by means of the technological tools of easy access, using greater efficiency between teachers and students as well as the methodology of work in the theoretical and practical field. These technological tools are fundamental for:

- Resolution of problems, exercises, experimental techniques, procedures and scientific analysis;
- Works with medium and high level of complexity. Being the process ascending or constant and it is given through the intervals of time with the use of technological tools;
- Feedback is given to the extent that understanding theoretical and practical assimilation generates a greater index of pragmatic responses in the

classroom environment, and the participation of the student group in an orderly manner and sequence.

Given the high participatory components, this model achieves educational integration as it is aimed at facilitating the search for information, innovation and solving individual and group problems using the web search engines, as well as the use and space in the networks raised in students.

Figure 2, illustrates the main components of the TIHE model. The curricular program has all information of a specific subject. Students and Teachers that are the main actors of the model. On the one hand, students will get skills and knowledge using technological tools during the class such as Facebook, Google docs, Prezi and Imaze, Sisweb and YouTube. On the other hand, teachers are the tutors and guides who follow the teaching learning process and use the class plan applying intervals.

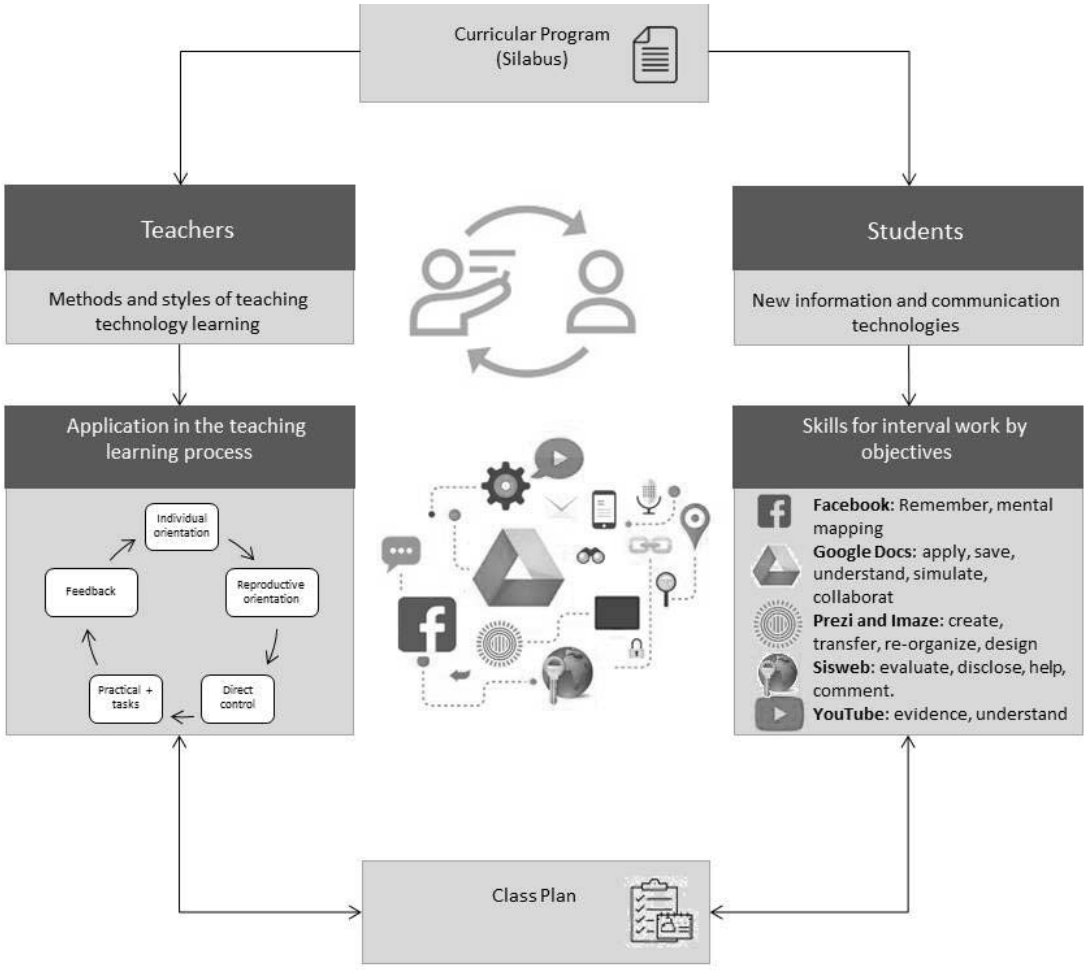

Figure 2. TIHE Model.

Tables 1 and 2 show the class plan model applying intervals. Teacher's active time of work through technological influence, is the action in which teacher allocates greater participatory priority to students through the use of technology. In addition, teachers promote class sessions linked theory and practice, meeting the purpose of the classes by scales of time and space called intervals.

The purpose of the class is set by teachers and allows measuring the contribution of the learning results. In addition, the student will be able to define the cognitive content of the facts such us theoretical and practical, given by the development and conception of the new mental maps.

The Methods of working by technological intervals are divided in three parts.

The initial part of the class by technological intervals represents the feedback in which the teacher interacts directly

with students remembering theories and practices performed in past classes. In addition, teachers in this part measure the mental efficiency and the level of participation of students as well as outstanding reminders to be worked through the purposes set for the current class.

After that, the principal part of the class contains the largest participation of students which is developed by technological intervals, in which the teacher must teach his subject with time and space. That is, as is the main part of the class, it lasts up to 75% of time, which is divided into three moments: 1st active participatory (inquiry of theoretical or practical topics); 2nd development (of group or individual work); and finally, in the 3th moment a conclusive to outline the classes and define topics. This part also shows that the active time of teacher only represents 15% of class time while the active time of students takes 60% of the class (Tab. 2). As a result of this principal part, students use their memory in the medium and long term.

The final part of the class is oriented as a complementary way to reinforce it, in a group or individual way, using technological tools for activities developed in each class. In addition, students can work with case studies and decision-making exercises regarding work developed in each of the contexts in Higher Education.

Class plan applying technological intervals.

Purpose of the class:					
Method of working by technological intervals		***Class realtime***	***Teacher active time***	***Student active time***	***Work Competences***
Initial	***Feedback***	10%	8%	2%	Feedback
Principal	***Methods and teaching styles***	75%	15%	60%	Facebook GoogelDocs Prezi e Imaze Sisweb Youtube
Final	***individual orientation***	15%	5%	10%	Practical + Tasks

TABLE I. TECHNOLOGICAL INTERVALS (TI).

TI	**Active time of teacher (Tutor)**		**Active time of student (Actor)**		**Stimulation of accelerated learning**	
					Cognitive stimulus	***Cognitive Result***
Principal	15%	Guide, Control Direct classes	60%	Participate Inquire Summarize Participate Evaluate	Verbal, Analytical Holistic Pragmatic Intuitive Concrete	Retention, Interaction Dynamism Elongation
Result	Use of memory in the medium and long term, through the stimulus for a longer attention span. (Retentive memory)					

TABLE II. PRINCIPAL PART OF THE CLASSS USING INTERVALS (TI).

IV. CONCLUSIONS

The theories of learning process have helped to create new ways of teaching-learning methodologies. Cognitivist (Gestalt theory) takes the concept of schemes and mental processes that allows the modification of knowledge and the establishment of meanings. In this sense, cognitivist using technological intervals, allow non-isolated theoretical contributions that reconstruct the individual knowledge and later the intra-individual plane that is given by the assimilation of theories and, by the use of the ICTs. On the other hand, Constructivism takes the concepts that prior knowledge serves as a scaffolding of new knowledge, where the student reorders and adapts the knowledge acquired in their cognitive process.

Finally, the social context theory of Vygotsky recognize the importance of the social environment in the process of acquiring knowledge because it points out that the influence of society through family, friends, school is important for the development of individual knowledge. In this sense, the educational culture is reflected in the dynamism of the 21st century with the use of new information technologies that is reflected in the socio-cultural epistemology in Higher Education, which generates great contributions in students, as well as a better projection in the teacher's plans and evaluations.

The proposed model is a compilation of specific theories of learning in the educational field, which are merged with the use of new pedagogical and didactic technologies in which the intervals are the time lapse for active work, integrating students to greater understanding and logical reasoning.

Regarding the use of technological tools that are applied in education, it will be necessary to produce more research to analyze carefully the characteristics they offer to apply them adequately in educational processes and to insist constantly on the importance that the technicians who develop technological tools know the principles of educational theories in order to their design facilitates the application in the learning processes.

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