

# **Integration of ICT in the Mexican Higher Education: The Case of the Virtual Environments of Learning**

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**Abstract:** The face of modern society is technology based life, and education is not apart form that. Thus, there is a need for reflection, analysis and decision making when it comes to inserting information and communication technologies to the teaching-learning process in schools and higher education institutions. In Latin America, this change in the paradigm of education has been slowly changing and particularly in Mexico a good number of Universities and other Higher education Institutions have started addressing the challenge. Although there is still a long way to go on the virtualization of programs to become available for a good number of future uses, it is time to start directing their efforts to that particular area. This paper presents a revision on pedagogical aspects, functions, and necessities when implementing Information and Communication Technologies (ICT) in Higher Education Institutions in Mexico and may also serve as a reflection exercise that can lead to facilitate and improve the programs and courses to come.

**Key-Words:** Information and Communication Technologies, Higher Education Institutions, Virtual Learning Environments, Educational Management, Mexico.

## **1. Introduction**

Our corrent society has been undoubtedly affected by the constant changes. The economy, culture, education and other social aspects have been influenced by globalization and the implementation of Information and

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communication technologies ICT. It has even been pointed out by UNESCO (2005) that there is a need for strengthening one's capacity to identify, produce, disseminate, use and deal with information in order to create and apply such knowledge to human development. The amount of information generated by the different sources available has contributed to create a more complex scenario. Castells (1999) states that the use of ICT is partially responsible for new ways of dealing with the processes associated to the collection and retrieval of information. Since distance shortens, other forms of communication arise along with different types of relationships between subjects whether it is synchronous or asynchronous.

Therefore, by overcoming space and time limitations, some features of our time emerge; flexibility, adaptability, and the capacity of survival to continuous changes are some of the characteristics of having ICT at their peak. Nevertheless, there is one more feature that needs to be highlighted: the social network, where collaboration is the key to build knowledge.

The use of ICT in the different areas of human activities is more and more frequent and so it is the case in education. Teaching – Learning Processes (TLP) are enhanced by the use of technology based tools that improve knowledge acquisition, whether it is individual or collaboratively, working in situ, blended or completely online.

For educational purposes, ICT have been considered as a pace downprocess. According to Moreno (2010) it is possible to identify three uses in education: quantitatively, if you only take into account the infrastructure or accessibility. The second, that has to do with the use of ICT in the TLP and finally the third, as a tool to find out more or research about interactions among subjects or the mastery of ICT. For UNESCO (2008) the level of technology appropriation is looked up by three main approaches: the first has to do with basic knowledge on ICT so students and teachers can start incorporating them to the TLP. The second is referred to the use of ICT to deepen into diverse issues that can be enriched through the use and implementation of them either individually or collaboratively. Finally, the third approach is about building knowledge with the participation of teachers and learners by different activities that promote creativity, innovation and critical thinking.

This paper offers a perspective of what is appears to be intended in a virtual learning Environment in some Higher Education institutions in Mexico along with some reflections on the features and their impact in education.

## **2. Virtual learning environments**

It is feasible to state that there is a semantic and pragmatic difference to what is understood as a virtual learning environment in Spanish, since there are two terms that are referred or related to the idea of what “an environment

entitles”. However, the first term includes the features of the second and as a practicality they are presented indistinctively in the following review.

An environment is referred by the Oxford dictionary as “the setting or conditions in which a particular activity is carried on” (2017). When it comes to the teaching-learning process (TLP), an educational context includes the physical, psychological and social frames where students learn (Martínez-Otero, 2000). It is also described as a dynamic system that includes the teacher’s behavior and their interaction with students as well as the interactions among students (Gómez, Valle & Pulido, 189). An environment implies the interactions of human beings in their natural and social surroundings and it is necessary a degree of awareness which can serve as a support towards the world and their existence. The previous means necessarily the use of language, culture, and some forms of communication that go deeper to what occurs in the mastery of life (Freire, 2006).

Sauve (1994) defines an environment as “a group of internal, biological-chemical factors along to the correspondent external, physical – psychosocial ones that promote or interfere social interaction. According to this author, there are dimensions of human interaction and perception that overlap. Such phenomenon corresponds to a proper “cosmovision” for a community, which integrates different perspectives that might be inclusive or complementary. In this scenario, the environment is the main source for research.

Human beings relate to their environments through a historical –cultural process by adapting or transforming themselves in some sort of symbolic correlation that interprets reality permanently (Díaz & Gómez, 2005).

In education, an environment is usually related to learning in a sort of active conception that involves the pedagogical actions that affect the learner and its interactions with the environment as such (Raichvarg in Duarte, 2003).

A learning environment for Naranjo & Torres (1996) and Pergolis (2000) is a dynamic interaction in an “educational city” where a human being is part of the process so it is necessary to examine intrinsic and extrinsic elements of the teaching learning process. In a learning environment, pedagogical actions are oriented so that learners can reflect on their own and others outcomes and relate them to their environment (Duarte, 2003).

Ospina (1999) offers a constructive view where a learning environment requires a permanent building on what forms part of the process. Cano and Lledó (1995) go further postulating some indispensable principles to create appropriate learning environments: a) establish the conditions for group cohesion towards common objectives, b) an environment as a way that allows interaction with different activities oriented to cognitive and social affective learning ; offer diverse scenarios to stimulate learning; d) offer, sub-scenarios that allow learners to feel accepted with their personal features and e) the environments identity reflects the group identity.

According to Chaparro (1995) the physical aspect of an environment which constitutes its historical-cultural context includes: (...) the dynamics in

educational processes such actions and experiences of each one of the participants; attitude social affective- material conditions, multiple relationships with the context and the necessary infrastructure to concrete cultural objectives that become explicit in every educational proposal.

For the authors of this paper an environment is more than the physical space that surrounds and wraps up human interaction. It represents a historical-cultural context that it is created and transformed by its participants in a process that influences the subject

Therefore a VLE is assumed as:

- A systematic, organized, but malleable and adaptable place that allows heuristic development, and the use of metacognitive skills, attitudes and emotions. A place for learning transference to the student (Mayer, 2000).
- A space that favors autonomous learning as a capacity to be in charge of one's learning (Holec, 1981) taking into account their personal features in a self-regulated, intentional, accumulative, constructive process that promotes the interaction, collaboration and cooperation of the learners, along with values development.
- An active learning model that allows the building of meaningful knowledge preferably based on real experiences with learners (Ausubel, 1976).
- A setting that promotes human exaltation by the development of one's capacities and commitment with their society in order to reach their maximum potential as human beings (Zilberstein & Olmedo, 2016).

### **3. ICT and VLE**

Human relationships are not restricted to physical interactions anymore. It is a current fact that the virtual being is recognized and taken into consideration for the creation of a new way of social interaction. A cyber-culture has become a media-relational universe, a space for a new language and new interactions (Martin-Barbero, 2002).

Therefore, there is a need to identify and describe the implications for the teaching-learning process since apart from the written-oral expressions, iconic language becomes relevant. Visual processing and thinking seem to be an important issue for VLE's so there is a need for pedagogical-didactic foundation when making decisions about content structures and learning objectives. The new roles for students, teachers, tutors, and facilitators need to be considered in compliance with this new order. Furthermore, it is important to find out whether they are native, or digital immigrants that need to adapt to this new environment (Prensky, 2001); or in other aspect related if they are residents use to internet tools or visitors, skeptical of online expressions (White & Le Cornu, 2011).

This new context affects original conditions for education. Television and Internet have changed the way of presenting information to children and adults. Martin-Barbero (2002) considers that visual knowledge is responsible for a cultural disorder that dismisses and illegitimizes teacher and school's authority. Moreover, many times the quality of contents is poor and are not purpose oriented.

Thus, a virtual learning environment (VLE) is taken as a group of criteria and processes to allocate a course so that it is possible to learn. The design has to leave its regular linear –sequence based form to become a dialectic constructive spiral which would reflect awareness upon the educational motives and the activities related to it. There is as well a constant assessment and a dismemberment of the sequence so it can be much more flexibility and creativity (Quiñones, 2006). The new organization goes further from technological elements and cultural representations, participant's interactions, economic and political matters.

In a VLE the possibility of interaction is established by more natural conditions for new generations. It is possible to sort out and line up information, the time and speed that an individual wants to study the contents.

Pedagogically speaking it is important to establish some principles to understand and adapt to this new form of learning. Constructivism assumes that the environment is a fundamental element in the human development of a learner. The subject is the result of the interactions between the inner self and the environment; therefore, the construction of a human being is associated to interactions with the environment (Carretero, 1997).

According to Quiñones (2006) the pedagogical principles that should be considered in the management and development of VLE are the following:

- An appropriate balance between knowledge and communication privileging the relationship over quantity. The design of learning objects has to be oriented to offer a socio-cultural appropriation that can lead to meaningful learning.
- Technology should be used to develop new pedagogical devices that allow the construction of competencies in collaborative environments with no-linear structures, associative and hierarchical that incorporate a diversity of sources and synchronous and asynchronous communication.
- The use of learning objects that present real world problems that enable students to take control of their process of instruction so by analyzing and synthesizing, through induction-deduction, abstraction- concretion, modeling and going from historical-logical can be able to make sense of experiences to build knowledge.
- The use of cognitive support strategies such as tutoring, role-modeling, guided learning where a learning platform is the way of constructing their own knowledge representation with freedom, flexibility as opposed as the traditional, rigid, schematic use in some teaching environments.

As it was stated previously, in Spanish there are two terms that refer to an environment, one that is included in the other. López, Escalera & Ledesma (2002) offer a group of conditions that belong to the term that subsides as part of the general concept of virtual learning environments as follows:

- A knowledge environment that comes from a curriculum design that are presented as contents as well as learning objects with interactive-adapted features.
- A collaboration environment, where interaction happens and it is also referred as feedback that can be synchronous or asynchronous.
- A counseling environment where tutoring is given to students from learning facilitators in a personalized way.
- An experimentation environment that serves as a complement of the contents to provide a vivid face if necessary.
- The management environment that is related to the control of the pedagogical process, the school and how students interact with it.

The authors of this papers have a perspective based on the general systems theory (Bertalanffy, 2006) due to the fact that it is possible to identify a supra system that represents the general environment where VLE are inserted. There is also an under system that is part of this VLE system and have features that follow an integrated structures in a logical-sequenced that point out to previously established objectives.

From this view, there are two types of elements that intervene in different moments of a sequence that is systematic a cyclic as follows:

- Objects: learning objects, ICT and LMS, contents, management, attitudes, autonomy, self-regulation, critical thinking, knowledge building, etc.
- Subjects: specialists (pedagogue, designers, experts in contents and ICT management), students, counselors (facilitators or teachers) and society. (See figure 1).

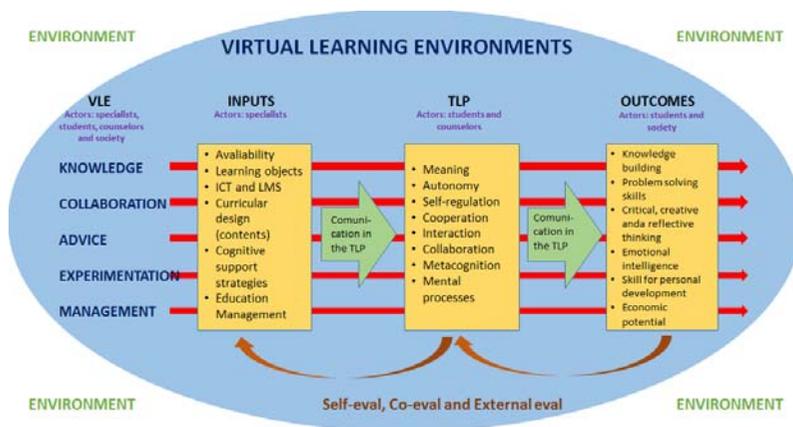


Figure 1. VLE from a systems approach

#### **4. VLE features in the Mexican context.**

As many universities in the world that have been moving towards virtual learning, Mexico has started to look has been increasing the number of higher education institutions that have been offering resources based on ICT as well as complete undergraduate and graduate programs where VLE are offered.

According to Bustos & Coll (2010) the use of ICT can be observed at different levels:

- a) As a complement of the teaching-learning process.
- b) To present specific contents.
- c) As a tool to support some contents in a specific manner.
- d) They are disseminated among students thanks to its portability.
- e) The connection takes place in a network.

The analysis of the use of ICT in Higher education is not an easy task but it represents the interest that has raised in the world in the last years. There have been some doubts from both teachers and students to incorporate ICT in the teaching-learning process. Diaz Barriga (2013) proposes that such process can be classified in three kinds of tendencies; in the first teachers are trained in the use of ICT. The second is oriented to the management of contents that can be used by teachers and students online, and the third, where ICT are seen from an integral perspective that has a psycho-pedagogical foundation and not only technologically speaking. In this case, it is important to take into consideration the different aspects that students might be affected by such as their age, their interests and others and based on that proceed to the design of didactic sequences that can help them to build their knowledge whether it is individually or collaboratively. In this way, previous knowledge of each participant can be taken into account and go from individual islands to knowledge networks.

Silvio (2004) considers important to transit from a traditional teaching learning paradigm to one that is oriented to learning by building one where a teacher becomes a guide, a facilitator of learning through the creation of virtual learning communities (VLC) that are horizontal relationships in synchronous or asynchronous form to favor the construction of knowledge networks among classmates and teachers.

To expand on the previous, Badía (2006) states the use of ICT on its own does not contribute to generate constructivist practices in the TLP. In this way, it is fundamental to have a clear intention along with appropriate planning where the some components are taken into account. First the conception of teachers from a guidance, mediation, facilitator function; students from an active role so they can be the lead actor in the construction of their learning. The contents included in courses and the form that are designed; and finally the use of ICT articulately for teachers and students.

De Souza (2007) sustains that the educational market is targeted by the Information Society and an economy based in knowledge, where the use of

ICT generates a new way of management. That new way differs from the relationship that is set among subjects, the information and knowledge, as well as the generation of collaboration networks, new pedagogies and new ways of spreading scientific knowledge.

Some studies carried on by Ersad, Gilje and Arnseth (2013) predicate that the main challenges that the XXI century society faces are the processes that allow the comprehension of the interconnections that take place among subjects, networks and communication processes that happen synchronously or asynchronously from the use of ICT. Therefore the information becomes knowledge by identifying, using, analyzing and transferring to other contexts where can be relevant.

Cassany (2012), highlights some meaningful changes that take places on the teaching learning process where ICT are present. Mainly it has been increasing the amount of information that is available, which can be seen in different formats, although there are no filters to assess their pertinence.

On the other hand, Llamas, Hoyos & Sifuentes (2015) expands on how the new contexts have completely changed the impact in the educational ambits and the concept of learning has become dynamic, it does not have a unique, true or definite value, but has been changing, evolving and enriching. Nevertheless, the notion of context has expanded and not only includes on site, partially on site or completely virtual and so that teaching-learning processes are built in each one of these situations.

Going through the previous approaches about incorporating ICT in the society in general and particularly in the educational ambit, it is relevant to insist that higher education institutions (HEI) have generated changes in their professional development offer, which have allowed them to respond to the demands of current society. From this perspective, Rama (2014) analyzes the process of incorporation

Of ICT in Universities, where it stands up the fact that the coverage of education has increased and how such phenomena serves people. Some have been inserted

On semi onsite programs while people who work have become a virtual user an also even face to face programs have adopted ICT in their courses. In this process of rethinking higher education in Latin America, Rama (2014) considers that distance education starts operating in the late 70's with the creation of partially on site models in places like Mexico, Equator, Colombia, Venezuela and Costa Rica. Some of the most important examples are "Universidad abierta y a distancia in Mexico (UNAD), Universidad Técnica Particular de Loja in Equador (UTPL), Universidad Nacional de Costa Rica (UNA) and Instituto Tecnológico de Estudios Superiores de Monterrey in México (ITESM).

Currently in México there are a number of institutions private and public that have adopted the virtual model: Universidad Virtual de la Universidad de Guadalajara (public), Universidad Virtual del Estado de

Guanajuato (public), Consorcio Clavijero del Estado de Veracruz (public), Universidad Virtual del Estado de Michoacán (public), Universidad Mexicana en Línea (private), Instituto Tecnológico de Monterrey Virtual (private), Universidad Autónoma del Estado de Hidalgo en la modalidad virtual (public), Universidad DaVinci (private), Universidad Tecnológica Privada en Línea UTEL (private), among many others that might have recently adopted the model.

The following models are present in most virtual universities in Mexico:

- Flexibility: the student has the freedom to organize the pace and time he/she dedicates to do his/her tasks and homework.
- Inclusiveness: students who find difficult to attend on site schools can participate in the programs.
- Cutting edge technology for education: virtual platforms are use such as Moodle, Sakai and Blackboard.
- Availability: students can sign in to do their tasks depending on their schedules since it is an asynchronous model.
- Interactivity: this type of programs can have synchronous or asynchronous activities such as chats or wikis and can be done working individually or collaboratively.
- Employability: students reinforce their professional competencies and improve their performance in the workplace thanks to the contents and tasks proposed in the courses.

Summarizing, in virtual models firstly, students develop skills and attitudes that are looked for and valued by employers and corporations, secondly; students are oriented to the development of enterprising in different contexts by putting their procedural, attitude and concept based knowledge into work.

## **5. Considerations when implementing a VLE**

An effective VLE must comply with pedagogical objectives that can impulse broader objectives in the HEL (known in Management terms as vision and mission principles). Therefore, it is necessary to measure performance and how the investment time-benefit is working (Sanchez, 2015).

Following the General systems approach, assessment must take place in broader and diverse directions. All the elements should be able to be measured in order to correct errors and understand success in others so they can be replicable so that a virtuous cycle can take place. Although, it is insufficient to concentrate efforts in measuring academic performance or in drop out levels in this type of courses. Measurement then should have a global character.

There have already been efforts to measure the quality for online education and there are several models to do so. Vetya & Rendón (2014) analyzed the subject and identified the best recurring practices among such models: institutional leadership, the management of teaching – learning

processes, students and teachers' support, the development of courses, ICT, capacities and effectiveness of costs assessment. In terms of assessment of VLE courses, it is proposed to consider four procedural perspectives that can be important and decisive in order to reach objectives. According to Kaplan & Norton (2014) It is important to clarify that such perspectives are presented in a sequence that is key to management since it is necessary to cover the first so the second can take place and so on, (see figure 2).



Figure 2. *Perspectives for measuring the effectiveness of BSC-based AVA.* Source: *Adapted from Kaplan & Norton (2014)*

The perspectives are described as follows:

a) Learning- growth perspective: where are included human capital management and knowledge management. That means organizational culture, training and workers development, knowledge management, systems for memorizing and organizational learning and human development in general. From this perspective it is important to address the question: under what condition are working the people in charge of developing these processes.

b) Processes perspective: in this case, it is important to concentrate the efforts on what are found to be the key processes of the system, those who add value and are the source of sustainable competitive advantages. A poorly defined and structured procedure may never be performed successfully. Teaching- Learning processes would be mainly be a productive process that needs to be defined and refined along with those support processes that make the first possible.

c) Customer/ client perspective: it is about seeing the students as external customers so that their satisfaction can be taken into account and be measured. The measurement contrast their expectations with the service rendered.

d) Economical/ Financial perspective: it is a very important view but it is only possible if the other ones have been accomplished. It is about identifying how effective the use of the resources and benefits has resulted.

This is not something exclusive in private institutions since public schools have committed to provide the best service available. All the previous perspectives have a direct and irrevocable impact on this one.

The advantages of this model are represented in the vision and strategies that each institution can use as key factors that can be measured and quantifiable to link and communicate specific objectives or actions. Moreover, it leads to an increase in the feedback to the system. For this purpose it is necessary to generate a key factors outline for each one of the perspectives, those bare variables that inform about the operation or behavior of a given activity in the institution. The factors are also defined as (...) “the relationship of qualitative and quantitative variables that let us observe the evolution or change of tendencies in the object or phenomena observed in concordance with the objective or goals foreseen or expected influences “ (Selltiz in Bermúdez & Rodríguez, 2013).

Defining key factors for the institution can serve the purpose of identifying and making unique a model adopted by an HEI assuming that they are adopted in an innovative well organized form. Such factors should come from the objectives of the Institution and be able to be analyzed in numbers that can increase or decrease. All members of the institution must know the model and participate in the definition of the factors they have assumed as key to reach their goals and agreed to. It is suggested that they can be equilibrated in number and importance among all perspectives depending on the characteristics of each institution.

Once the key factors for VLE in HEI are decided and defined it is important to include in the model of implementation a way of assessment and continuous improvement so it can be easily and effectively replicable to other HEI with similar resources or features.

## **6. Conclusions**

Technology based models for education are a part of our modern society so it is important to continue analyzing in what ways and to what extent they can be inserted effectively and purposefully. Therefore, it is mandatory that every participant in the teaching-learning process can be aware of it and prepared to understand the changes to traditional models that is implicit.

Pedagogical processes need to be adapted to serve the same purpose but in many different forms. VLE offer limitless possibilities but face us with a great deal of challenges. More and more every aspect of human development is being transformed thanks to the insertion in a virtual reality that started with the use of the internet.

The use of ICT in education offers the possibility to get more with less resources, which can enable students from different social spheres to be included, promoting a more democratic reach for higher education. As for a theoretical perspective of the implementation of ICT, the constructive model

offers an interesting approach since it considers the environment a vital part of the learning process. Although, there are still some aspects in education and pedagogy that need to be addressed.

One of those important matters is the amount of training for students and teachers that is necessary as well as the resources needed to maximize the outcomes. Finally, it is necessary to say that the previous analysis offers only a few elements that should be taken into consideration for the understanding and implementation of successful VLE in Mexico. It is a fast growing area and many other features are arising all over the world, so it is a must to continue expanding on the matter so it would be possible to offer the best available model to present and future users.

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