

Systematic analysis of Quality Technology Enhanced Learning Environments in higher education: an organizational perspective 2.0

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Technology Enhanced Learning Environments (TELE) theme, in Higher Education Institutions (HEI), is a hot topic in research and it has been taken into consideration by the policies of several international organizations and countries. Several evaluation models have been proposed that cover different dimensions of TELE, and the scale of analysis of these models ranges from: i) an organizational, Cartesian, systemic and holistic view; ii) a micro view, in which certain environmental elements are considered (eg material / content, student assessment, tutoring).

The HEI are complex organizations with organigrams with several levels of decision and range of action (university, schools/colleges, departments, courses,...). These structures/agents are accountable and act in different levels of TELE ranging from the holistic view, which belongs to the hierarchically superior structures, to the smaller elements of the system, namely each department or course.

In this chapter, we do a literature review on how learning organizations are structured and learn by focusing our analysis on the advantages which result in meeting the challenges of this globalized world, where the only constant is change. We also intend to review what has been proposed by examining some of the most significant assessment models of TELE in use today. This analysis will be achieved by positioning these models in a matrix, built on the dimensions proposed by the "E-learning quality - ELQ" model developed by the Swedish National Agency for Higher Education. The ELQ model considers ten dimensions (1. Material/content, 2. Structure/virtual environment, 3. Communication, cooperation and interactivity, 4. Student assessment, 5. Flexibility and adaptability, 6. Support: student and staff 7. Staff qualifications and experience, 8. Vision and institutional leadership, 9. Resource allocation, 10. The holistic and process aspect). These dimensions were identified through the analysis of i) policies, projects and working networks developed by several European organizations, ii) policies of governmental agencies and national organizations dedicated to quality assurance in higher education, especially in e-learning, iii) published scientific articles. It is expected that the matrix will reflect a systemic view, where the different evaluation models are contextualized in the dimensions proposed by the ELQ and the links between the models of holistic view and those focusing on smaller elements of the process teaching and learning will be pointed out.

Although it is true that to effectively evaluate the global policies of TELE, or each one of their dimensions, it is not enough that the HIE import and apply evaluation models, as it is also essential that these organizations develop and adapt their own working methods and ensure their internal competence. On the other hand, it is equally true that the models are important references that enable each HIE to build and adapt their own assessment mechanisms.

The positioning of the different models of evaluation in a matrix, which runs along the critical dimensions of TELE present in the ELQ, with a spectrum analysis between the micro and the macro-scale can be an important tool for the organizations enabling them to define their own evaluation models, identifying who evaluates, what is evaluated and in what context.

Keywords assessment models; higher education; learning organizations; technology enhanced learning environments

1. Introduction

Peter Vaill [1] used the term "permanent white waters" to describe the time in which we live: times of constant change and unpredictability, which require that organizations have the capacity to learn and work simultaneously to adapt to the "white waters", which symbolize the troubled as a result of the foam produced by the stormy ocean. During most of the twentieth century, winning organizations were characterized by clear boundaries of authority and the hierarchy of decision-making. These organizations saw people as an important factor of production or, using a current expression, people were seen as "human resources." Peter Senge [2] considers that it is exactly this idea - of seeing people as "resources" to be used by the organization - which hinders the capacity to be flexible and adaptable.

In the current scenario, where the only constant is change, the way institutions learn becomes a factor as or more important than the control of their production processes. The "knowledge-based organizations" or "learning organizations", are inherently more flexible, adaptable and able to continually reinvent themselves and will have competitive advantages in this world of rapid changes increasingly interdependent. These learning organizations require less rigid hierarchies, with the distribution of decision-making at all levels, and developing a culture of the valorization of systemic thinking, where everyone is able to understand the common goal and contribute to it and not just play a role of human resources available for use.

In this line, research about the processes of change in organizations, by Kotter [3] and Kotter and Cohen [4], concluded that the speed of change in the various aspects of society, will be increasingly accelerated, requiring the ability for rapid adaptation. During the period between the two studies, Kotter is convinced that 90% of organizations

ignore important external changes or, when they identify them, they try to adjust through ineffective actions: too much money is spent to achieve poor results and with too much frustration from everywhere [5].

In higher education there are several social, economic and educational factors that push institutions for change. A guide published by UNESCO [6] on higher education highlights the main challenges for HIE in the near future:

- **Internationalization of institutions** that results in increasing competition in attracting students and in deepening cooperation between institutions in joint ventures;
- **Internationalization of education policies**, as with the Bologna Process that created the European Higher Education Area (EHEA);
- Deregulation of the sector and the growing **autonomy of HIE** in defining policies and strategies;
- the need to **differentiate the training offered** to meet the increasingly heterogeneous public and social changes, especially the employment structures.

In the Information Society (IS), where technology is present and transforms all human activities, the Technology Enhanced Learning Environments (TELE) are essential to organizational change and pedagogical re-engineering. Therefore, they are crucial factors for the competitiveness of the HIE. The *Horizon Report 2011* [7] points out the biggest challenges for integration of technology in HIE:

- **digital literacy** that continues to gain importance as a key competence in the various subjects and professions;
- economic pressure that requires **new training models**, causing an unprecedented competition with traditional models. As a result, the most innovative HIE develop new models to serve students, such as streaming survey courses over the network so students can attend from their dorm or other locations to free up lecture space;
- defining of **new forms of assessment**, compatible with the new ways of learning, publishing and searching: the e-books, blogs, multimedia products, network presentations and other forms of academic work are increasingly important;
- monitor and **integrate technology** into the teaching and learning process, which results in a rapid proliferation of devices and software (eg. augmented reality, serious games and simulators);

This study is a mini-review of previous research on the subject of the TELE development in HIE. The lenses of analysis were focused on two key aspects in the quality of these environments: the learning processes of the learning organizations and the mechanisms of evaluation and control. Thus, the goals of this chapter are: i) present the main features that HIE must have in order to become learning organizations in the development of TELE, enabling them to respond to social, economic and educational challenges that the quick pace of SI imposes ii) position some of the most significant TELE assessment models of today in a matrix constructed based on the dimensions in the model for assessing the overall quality of e-learning (ELQ: E-learning Quality), developed by Swedish National Agency of Higher Education, iii) provide guide-lines for HIE to build their own evaluation models, tailored to their specific contexts.

The relevance of this work is justified by the timeliness and importance of the subject. Indeed, many HIE are trying to introduce change through technology, but about 50% of these investments are considered failures or fall short of expectations [8]. Understanding how successful institutions are able to adapt to the "permanent white waters" becoming learning organizations is therefore essential. The mechanisms to evaluate quality are also very important to control, re-define and enhance policies in the field of the TELE in HIE, hence the usefulness of putting them together and place them in a matrix. If it is true that the mechanisms of quality parameterization vary according to each context, it is also true that the theoretical models of assessment can be useful guides in the construction of models in context, that include variables, criteria and specific indicators of each HIE.

In addition to this introduction and conclusion, this study includes four other sections: section 2 describes the characteristics of learning organizations and explains how their structure facilitates the use of the potential of new ways of communicating and interacting of individuals. It is also shown how the flexibility in the model of organization is an asset in a globalized world of rapid change where technology is ubiquitous.

Section 3 explains the importance of evaluation and control models to guarantee the quality of the TELE in HIE. It highlights the complexity of the TELE, systems consisting of several interdependent dimensions. To illustrate the complexity of these systems, the model of Global Quality Assessment ELQ [9], proposed by the Swedish National Agency of Higher Education (SNAHE) is explored. In ELQ ten dimensions that run throughout the TELE, from the most basic elements of the teaching and learning process to a systemic and holistic view of the entire environment, are identified

In section 4, some of the most significant TELE assessment models of today are positioned in a matrix constructed based on the model ELQ dimensions;

In section 5 we define a set of procedures so that each HIE can build its own system of indicators that enables the collecting of reliable data, contextual (ecological validity) on the dimensions and dynamics of the TELE.

2. Learning Organizations 2.0

In 2006, *Time Magazine*, in the issue where they elect the personality of the year, put a computer on the cover with a mirror on the screen so that the reader would see the photograph of the elected person reflected: You. Time magazine

elected as the personality of the year the individuals that all around the world are changing the way we learn, communicate, trade, work, civically intervene, in short: the way we organize ourselves [10].

Tapscott and Williams [11] reflect on the implications that these changes have on the organization of institutions, putting into question the organizational models strongly hierarchical, with strict lines of authority, in which each person is subordinate to another, in which decisions are on the side of leadership and compliance with the guidelines on the side of employees, in which the institution is in a field and the community is in another. If it is true that the hierarchies are not vanishing, is also observed that, thanks to the Internet, processes for innovation in production of contents, goods and services outside of traditional hierarchies have been developed, based on **collaboration and self-organization**, rather than based exclusively on hierarchy and control. In this line, several authors, Friedman [12], Kotter & Rathgeber [5] Hickaman [13], Senge [2] highlight the importance of institutions flexibility and participation of individuals in adapting to volatile and increasingly competitive demands of the globalized world immersed in technology. Drucker's statement "Knowledge has to be improved, Challenged, and Increased Constantly, or it vanishes," summarizes the need for constant cognitive upgrades in organizations.

If the environment outside the organization assumes an increasing complexity, the same happens internally. The current generation of **digital natives and immigrants** [14] communicates and interacts differently, valuing collaboration and self-organization. Poor understanding of the potential of these new ways of working and the difficulties in upgrading the old system are the main barriers to the adoption of the Organization 2.0 concepts and practices [15].

We use the term "**organization 2.0**" as a way to draw a parallel with the concept "web 2.0" The term web 2.0 was used for the first time, by Tim O'Reilly in 2004, and it is associated with applications that facilitate sharing information, interoperability, user-centered design and collaboration on the world wide web. A web 2.0 is intended to reflect a paradigm shift with regard to web 1.0: in web 1.0, users are limited to passive viewing of content created by others, in contrast the web 2.0 allows interaction, collaboration, dialogue through social media and users assume the role of consumers as well as creators (prosumers) of content [16]. Applying this paradigm shift to the organization of institutions, it may be said that organizations 1.0 comply with rigid hierarchies, where most people play the role of mere executors of orders coming from higher hierarchical levels. In the organization 2.0 collaboration, self-organization and creative contributions of individuals are valued.

Most organizations start their activity under the paradigm of simplicity, in which a small number of people get together around an idea. From 150 individuals upwards, organizations enter the paradigm of complication (which is distinct from the paradigm of complexity, see table 1), where knowing everyone who works there is difficult, requiring the creation of intermediate structures of leadership. Most of today's companies have a complicated organization, where there is a vision of the company within the bodies of command, but not at the individual level. New levels of control and supervision are created and specialization is the path taken for the acquisition of knowledge and efficiency gains. In order to overcome the inertia of these complicated processes, some organizations try to become **learning organizations 2.0**, taking advantage of collaboration and self-organization of people, instead of relying solely on rigid hierarchies. The introduction of technology encourages this process of flattening hierarchies, because, traditionally, middle managers act as amplifiers of the command voice, which now is done by the software that controls and commands (workflow) the activity of each person. Cordell and Simon's [17] work confirms the impact of technology in reducing costs and increasing efficiency in the coordination activity within organizations.

The expression "**Wirearchy**" is used to define the emerging organizational principle that reconciles two seemingly opposing visions: the vision of the hierarchical organizational structure and the organizational vision 2.0 [15]. Husband [18] defines Wirearchy as follows: "a dynamic two-flow of power and authority based on knowledge, trust, credibility and a focus on results enabled by people and technology." table 1 summarizes some organizational changes during the course of simplicity to complexity.

In the Wirearchy philosophy, the institution's organizational theory is based on the appreciation of networks, where collaboration and self-organization of individuals coexist with a hierarchy, forming a complex ecosystem, which enables the dissemination of emerging good practices. The knowledge within the organization has many more hyperlinks than an inflexible hierarchical model with rigid lines of authority. The inner walls of the organization become permeable, in which the official channels of communication are complemented by a large number of informal communications. This model of organization allows the emerging knowledge to be spread much more quickly, which results in an increase in the company's ability to provide better service to its customers. In this sense, also the exterior walls that separate the organization from the social environment become more permeable, facilitating the relations with its social partners and the flexibility to respond. If institutions are unable to adapt to the volatile demands of the environment, others, more flexible, will take their ecological niche.

Table 1 Organizational changes during the journey from simplicity to complexity [15]

	Simplicity	Complication	Complexity
Organizational Theory	Knowledge-Based View	Learning Organization	Value Networks
Attractors	Stakeholders (vision)	Shareholders (wealth)	Clients (service)
Growth Model	Internal	Mergers & Acquisitions	Ecosystem
Knowledge Acquisition	Formal Training	Performance Support	Social
Knowledge Capitalization	Best Practices	Good Practices	Emergent Practices

According to Senge [2] the only sustainable competitive advantage of the organizations is the ability to learn faster and better than their competitors. Thus, the challenge facing every organization is to know how to promote the flow of information fundamental to the promotion of **social learning**. This is an iterative process that can be adapted to each context, but it is essential that the institution promotes a set of principles [15]:

- **Listen:** The first step in social learning is to pay attention to what others are doing and listening. The organization must find and call attention to sources of reliable information. Listening is essential to identifying and promoting good practices and innovation and to fix bottlenecks.
- **Converse:** The valorization of the vertical and horizontal dialogue helps spreading valuable information among professionals. The circulation of information is important to achieve an organizational culture.
- **Co-create:** to deepen over time the cooperative activities and sharing of thought. Working in a transparent way takes some time to start.
- **Formalize & Share:** Sharing business and academic studies on social learning can help understanding the benefits of this philosophy, so that sharing becomes a common place in each working day.

In previous studies there are several authors who emphasize the role of minorities in stimulating divergent thinking, a catalyst for creative thinking [19-22]. Ways of computer-mediated communications enhance the expression of differing opinions and minority arguments [19, 23]. From here two fundamental variables for the learning organizations can be extracted: ITs and the relationships between people. Benbasat and De Sanctis [24] suggest a shift from a transactional paradigm, more focused on IT, to a more people-centered logic – a more relational paradigm. In table 2 this paradigm shift is synthesized, where the relational aspects, including the emotional ones, occupy a prominent place. In fact, the emotional aspects are considered key factors for the success of individuals and institutions. To illustrate their importance Goleman made famous phrases such as "Emotional Intelligence"[25] and "Social Intelligence" [26]. In the relational paradigm, aspects such as trust, credibility, commitment, joint development and learning communities are central to the strategy of the organization.

Table 2 Transactional and relational paradigms (adapted from [24])

	Transactional	Relational
Focus	Economic Engineering Cost and Volume of Transaction	Social Humanistic Change Context Emotion, Trust, Learning and credibility
User-machine Communication	Increasing in Efficiency Performance Improvement User-friendliness Flexible Interfaces	Enhancing the User Commitment Confidence Pleasure and entertainment value
User-designer Communication	Efficient Information Exchange Information Modeling Cognitive map Black box as a goal	Mutual understanding Socio-technical design Joint development of applications Knowledge brokering Role Switching
IT Unit - Business unit Communication	Strategic Alignment Organizational analysis Analysis of critical success factors Technical planning standards	Joint development Reengineering of business processes Knowledge Management <i>Online</i> learning communities

3. The importance of evaluation and control to guarantee the quality of TELE – the ELQ model

Information Technologies (IT) have revolutionized the concepts of time and space and are causing profound changes in how people learn. Expressions such as *e-learning*, *blended learning*, *m-learning*, *collaborative learning*, *learning communities*, *media in education*, *social media*, *Personal Learning Environment*, *Cloud Learning Environment* and others, are ubiquitous in educational research. These expressions do not always have a rigorous definition that facilitates communication and sets limits in relation to their use. However, they have in common the fact that they emphasize the importance of technology and the flexibility of time and space for learning. The concepts of e-learning, m-learning, b-learning, c-learning and other similar ones are increasingly overlapping. Just as the celestial bodies are aligned for an eclipse, these terms have also aligned and will gradually eclipse. In fact, it makes progressively less sense learning without electronic means, namely the web-based ones, and, moreover, the boundary between learning on site and distance learning, due to the increasing importance of the **Personal Learning Environment** (PLE) that students build in the cloud, is increasingly blurred. The trend is that these expressions intended to define ways of learning will merge in the future, lose their prefix ("e", "m", "b", "c", ...) and give rise to the term "**Learning**" which will be intrinsically linked to all these meanings.

In this chapter, we chose to use the concept (TELE - **Technology Enhanced Learning Environments**) that we consider to be comprehensive and inclusive of these definitions. In *Report of the Technology Enhanced Learning Committee* - University of Texas, it is defined as follows: "*Technology enhanced learning leverages technology to maximize learning within an environment of sound course design that can offer students the options of time, place, and pace and emphasizes different learning styles. There is no one definition for the look or feel of a technology enhanced course; instead, this effort occurs along a very broad spectrum that at one end can include a course with only minimal technology enhancement such as a web site with an electronic syllabus, while at the opposite end is found a robust, multimedia rich, interactive, collaborative, fully online course.*" [27]

Although the TELE have been a subject on the agenda of various international organizations and individual countries for a long time, only recently have we started discussing how the quality of these environments should be evaluated [9]. The issue of TELE assessment seems to be suffering a boost. In fact, several international associations have been promoting projects, seminars and publications on the **quality of the TELE**, making some proposals on **how to evaluate** them, such as: European Distance and E-learning Network (EDEN) and the European Association for Distance Teaching Universities (EADTU), European Association for Quality Assurance in Higher Education (ENQA). In national organizations of individual countries assessing the quality of TELE is also an issue that is increasingly being considered. In research, there are multiple scientific events and published articles on this topic. However, when we move to the scale of the HIE, where TELE materializes itself, the emphasis on evaluation of these environments is still far from the importance they justify. About the state of assessing of the TELE, the ELQ report, reads: "The analyses indicate that while e-learning is on the agenda in many European contexts and in individual countries, it is only recently – and much more sporadically – that the subject has been broached of how e-learning quality should be assessed. In many organisations, quality in e-learning appears to be a non-issue." [9]

To introduce an effective change in organizations through technology it is necessary to develop an evaluation process that ensures quality and functions as a guide to action. From the point of view of the American Society for Quality: "quality" is what defines and guides the individual success of organizations and communities without interrupting their process of evolution [28]. It is a continuous process of development and pursuit of best practices. If assessment is recognized as a key factor in guaranteeing the quality of the TELE, the way they evaluate and which aspects should be evaluated are the most controversial issues.

The dimensions and indicators of an evaluation system have three main objectives:

- informing the general public or government on the status of the system;
- monitoring the progress of a policy, strategy, or plan that has been implemented (or one of its components);
- managing the higher education system or an institution as a whole [6].

This way you can see that an **evaluation model** must be linked to policies, strategies and objectives of each institution. The import and direct application of an evaluation model will hardly contemplate specific variables, criteria and indicators of a given organization, so its effectiveness as a management tool to improve practices will be limited. In addition, "the assessing body also needs to develop and adapt its own working methods and guarantee its internal competence" [9]. However, this view does not mean that in the evaluation of TELE (or its components), the HIE do not take into account the numerous contributions made by international and national organizations and the vast scientific production. In fact, the produced works are key guides for action, in which the HIE should base their own definitions of the evaluation models. This raises the question: What size/ quality aspects should be considered in setting the evaluation model?

The **ELQ** (a model for quality assessment of e-learning - Quality aspects and criteria) tries to answer this question, by identifying the fundamental dimensions of a TELE, having been based on the following methods and sources of information:

- Analysis of relevant documents of European institutions and organizations on policies and projects in the area of learning in higher education in the European Union (EU);
- Approaches taken by the national organizations of leading countries in e-learning;
- Themes and quality aspects of e-learning in higher education currently discussed by the scientific community in specialty magazines.

The main advantage of this methodology lies in the intersection between the organizational perspective and the perspective of research. In the center of Figure 1 the identified aspects of quality are sorted. The order does not reflect an order of importance, but it follows the logic of a zoom out, in which one starts with the smaller elements of the teaching and learning process to a panoramic view at the level of the organization, therefore, more systemic and holistic. This alignment shows the complementary perspective of the two sources of information used in this study.

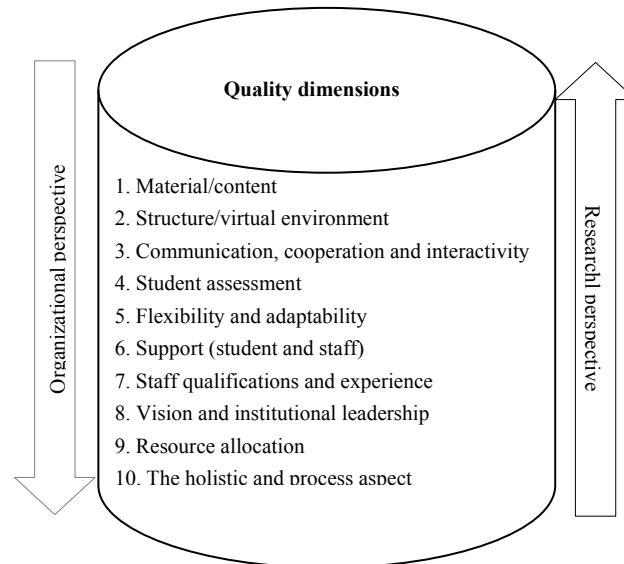


Fig. 1. Quality dimensions in the model for assessing quality in e-learning (ELQ model)

The ELQ model highlights the complexity of the analysis of TELE within organizations. The Psychology way of thinking of "Gestalt" is a good metaphor for understanding the dynamics of complex systems, such as the TELE in HIE. According to the "Gestalt", a system is more than the sum of the different perceived dimensions, to the extent that the interaction between the different components affects its organization. Applying this idea to the theme of the evaluation of the TELE in HIE, it is important to ensure that the evaluation model provides an analysis of the different dimensions and different scales (e. g. credit unit, course, department), so that their own processes and performance can be controlled. However, this approach is not enough, as it is necessary to complement it with a more systemic and organizational view, so that the policies of the TELE can be coherently measured.

4. Positioning of evaluation models of TELE in the ELQ

The ELQ model includes dimensions of benchmarking and quality, recognized by national and international organizations, focusing on aspects such as leadership, organization, support, qualifications of personnel, resource allocation and degree of flexibility. It also reflects the dimensions identified in the work done, which focuses predominantly on the most basic aspects, namely the components of the structure of the virtual environment and the material / content. In each dimension, the ELQ model predicts 3-4 quality criteria, which serve as measures to deal with the problems and issues identified at the institutional level. The quality criteria are open and revolve around three issues:

- a) explanation of strategies; Placement of models for assessing the model TELE ELQ
- b) implementation of a);
- c) evaluation and improvement of a) and b) [9].

In the matrix of table 3 the ten dimensions present in the ELQ model are listed [9]. For each of these dimensions, we associate studies and theoretical models, which identify criteria and ways of operationalizing and assessment. This work seems useful and complementary to the ELQ model, since the presentation of different perspectives and theoretical positions helps to understand the state of the art, to select more carefully the indicators, being therefore a useful guide in defining the evaluation model. With this, we are not trying to defend an import and direct application of models, since the parameterization mechanisms vary according to each context [29], so each organization must look for its specific

criteria and indicators that respond to questions of well-defined contexts [30]. However, we believe that a good theoretical support is essential so that each organization can build the tool to evaluate its TELE.

Table 3 Positioning of some evaluation models in ELQ

Dimensions	Model	Factors	Focuses
Material/ content	Quantitative Evaluation Framework [31]	Technical, ergonomic and pedagogical	Quantitative measurement of quality in digital content
	Assessment of pedagogical usability criteria for digital learning [32]	1. Learner control, 2. Learner activity, 3. Cooperative/Collaborative learning, 4. Goal orientation, 5. Applicability, 6. Added value, 7. Motivation, 8. Valuation of previous knowledge, 9. Flexibility and 10. Feedback	Pedagogical usability criteria for digital learning
	<i>Other models:[33-38]</i>		
Structure/ virtual environ- ment	Technology Integration Matrix [39]	Characteristics of the Learning Environment (Active, Collaborative, Constructive, Authentic, Goal Directed)	Learning environment/ Inclusion of Technology on curriculum
	OLES .Online Learning Environment Survey [40]	1. Computer Usage; 2. Teacher Support; 3. Student Interaction and Collaboration; 4. Personal Relevance; 5. Authentic Learning; 6. Student Autonomy; 7. Equity EQ; 8. Enjoyment and 9. Asynchronicity	Online learning environments
	<i>Other models: [41-46]</i>		
Communi- cation, cooperation and interactivity	Classifying online communities [47]	User Type, Usability, Purpose, Tools, Learning models	Social interactions
	Supporting Asynchronous Discussions Among Online Learners [48]	Attendance, participation, engagement and relevance	Forum, Blog
	<i>Other models:[40, 49-51]</i>		
Student assessment	Evaluating Training ResultadosPrograms: The Four [52]	Reaction, Learning, Behavior, Results	Professional training
	Eporfolios [53]	Workplace/process, showcase/ product	ePortfolios
	<i>Other models:[54-58]</i>		
Flexibility and adaptability	Cooperative Freedom: An Online Education Theory [55]	Time, Space, Pace, Medium, Access, and Content	Relation individual independence/ collective cooperation
	Connectivism [42]	Individual/ organizational learning; Formal/ informal education	Spaces and structures which will serve the needs of our orgziazions
	<i>Other Models:[59-61]</i>		
Support (students and staff)	The Distance Education Learning Environments Survey – DELES [41]	1. Instructor Support; 2. Student Interaction and Collaboration; 3. Personal Relevance; 4. Authentic Learning; 5. Active Learning; 6.	Abordagem psicossocial

Dimensions quality	Model	Factors	Focuses
Support (students and staff)	Student barriers to online learning: A factor analytic study [62]	Student Autonomy. 1. administrative issues, 2. social interaction, 3. academic skills, 4. technical skills, 5. learner motivation, 6. time and support for studies, 7. cost and access to the Internet, and 8. technical problems	Relation between background characteristic/ demographics and outcomes of their online learning.
	<i>Other models: [43, 63]</i>		
Staff qualifications and experience	Model of teaching and learning online [64]	Five levels of the tutor's role as the sharing community is built and developed	Tutor's role in constructivist pedagogies
	Toward an Effective Quality Assurance Model of web-Based Learning: The Perspective of Academic [65]	1. Institutional Support, 2. Course Development, 3. Teaching / Learning Process, 4. Course Structure, 5. Student Support, 6. Faculty Support, 7. Evaluation and Assessment	Quality in the web-based learning environment
<i>Other models: [41, 43, 66, 67]</i>			
Vision and institutional leadership	Process of introducing organizational change [13]	Leadership, vision, ethics / values, culture, inclusion, change, building capacity, social responsibility	Introduction of change in organizations
	Eight Steps for Leading Change [3]	Products and services; Human resources and processes	Introduction of change in organizations
<i>Other models: [43, 63]</i>			
Resource allocation	Resources allocation and distribution: OERAD [68]	Electronic content/ services e-learning network/ resource repositories.	Interaction users/ resources/ repositories in a networked environment
	Digital Library of Educational Resources and Services [69]	1. Reusability, 2. Quality of content, 3. Design and usability; 4. Economic efficiency	Learning Objects/ Educational Resources and Services
<i>Other model: [70]</i>			
The holistic and process aspect	Program Evaluation in e-learning [71]	1. Pedagogical , 2. Technological , 3. Interface Design, 4. Evaluation , 5. Management 6. Resource Support , 7. Ethical, 8. Institutional	Systemic assessment of the different dimensions of e-learning
	EFQM - Excellence model [72]	1. Tutor Support, 2. Collaboration, 3. Technology, 4. costs- expectations- benefits, 5- Information transparency of provider/ course, 6- Course structure/ Presence courses, 7. Didactics	Systemic assessment of the different dimensions of e-learning
<i>Other models: [73-75]</i>			

The **material / content** dimension is crucial in the quality of the training process. It is therefore important to define and evaluate strategies that respond to questions such as: Who produces the material? Which pedagogical philosophy(s) must the contents comply with? How are property rights guaranteed? Which technical and ergonomic requirements must be met? [9] The different theoretical models shown in table 3 answer these questions with different analytical lenses. The "Quantitative Evaluation Framework" [31] focuses mainly on theoretical, pedagogical and ergonomic aspects, making a quantitative evaluation of the resource. This evaluation is reflected in a number that wants to measure the quality of the resource. The model proposed by Nokelainen [32] makes an evaluation with a more qualitative

approach, strictly focusing on educational aspects, analyzed in the light of constructivist theories. Therefore, for the same dimension, these two models have different analytical perspectives. For this dimension other models, which due to space limitations we cannot explore, are also shown in table 3, but they have very eclectic focuses and lenses of analysis. This diversity of models allows the idea of different analytical perspectives, encouraging the redefinition of strategies of organization in the field of the TELE and their evaluation.

The definition of policies in the field of **structure/virtual environment**, based on pedagogical considerations and the technical environment of the institution, is a key factor in the quality of TELE. The fast technological changes and social requirements require constant updates and improvements to these environments [9]. The Technology Integration Matrix [39] illustrates five stages of the organizational change to achieve the highest level of change in a TELE. Ideally, a TELE evolves from an introduction phase to a transformation phase, which is reached when technology is used effectively by everyone in the organization and the culture of knowledge sharing is the rule. In the transformation phase, every TELE is immersed in technology and does not work without it. A culture of participatory evaluation is essential in the construction, adaptation and evolution of TELE to higher levels of integration. The evaluation system Online Learning Environment Survey OLES [40] is based in the perspective of research on the evaluation of the classroom environment, in the dynamics of distance education and in the contributions of technology in teaching and learning. This approach involves nine dimensions, perfectly framed in constructivist philosophy, and fifty-four factors on a scale of five levels that explains not only the existing perception of students on the system under study, but it also seeks to project its expected ideal [40]. Other models, with other perspectives, are listed in this dimension.

The TELE impose new ways to **communicate, cooperate and interact**, so the right planning and technical framework of the educational platforms of communication and interaction are key [9]. Also in this dimension, the literature is rich in eclecticism on the approaches as it includes from more holistic perspectives (social interactions) [47] to more focused approaches (eg. defining criteria for evaluation in forums and blogs) [48].

The evaluation methods determine how students approach their studies, and therefore they are pedagogical aspects of great importance. The new constructivist philosophies value **assessment methods** that take into consideration creativity, critical and deep thinking. The TELE are also associated with greater flexibility in time and space in the building of knowledge [9]. This leads to new requirements, namely in the confirmation of identity and authenticity of the students' contributions. The valorization of ePortfolios as learning evaluation tools [53] and the impact of evaluation in terms of reaction, learning, behavior and student results [52] are examples of two completely different perspectives of addressing the evaluation of this dimension.

Another crucial dimension in terms of quality and competitiveness of TELE is the degree of **flexibility**. Flexibility can be interpreted in different ways: flexible hours, flexibility in content and tasks (students can choose and specialize themselves), flexibility in the attendance system [9]. The new generation of students expects to access information, interact and learn from anywhere, at any time, with anyone. This greater flexibility is associated with new technological and pedagogical challenges. The *Connectivism* [42] and *Cooperative Freedom* [55] are models that reflect these new ways of learning.

In the **support (students and staff)** dimension not only technical aspects should be considered, but also educational and social [9]. Here too there is a wide variety of models, such as: i) *The Distance Education Learning Environments Survey model* (DELES) [41], which is a psychosocial approach from the standpoint of the student, ii) The work of Mulenbourg & Berge [62] which establishes the relation between background characteristic/demographics and outcomes of their online learning.

The **staff qualifications** are a key-factor in the success of TELE. All employees, not just the teachers, should systematically acquire and update their knowledge and skills [9]. Rosenberg [75] points out the lack of a core of experts as one of the factors that lead to the failure of TELE. The work of Yeung [65] deals with the qualifications of different actors within the TELE. There are other studies more focused on the skills required of specific actors, for example, of teachers [63, 64].

The long-term **vision** should guide the existing practice and establish a common goal for the organization. Promotion of research, quality assurance, promotion of different knowledge are all key factors for improvement and innovation. The national and international cooperation between institutions is also increasingly important in the development of these environments [9]. The strategic vision should involve all actors and create channels for feedback of results. The models de Hickman [13] and Kotter [3] on the processes of introducing change in organizations, are two models that question in a profound way the importance of the "Vision and institutional leadership" dimension in the success of the initiatives.

In a TELE, part of the resources must be reallocated from the physical space into technological infrastructures. On the other hand, the physical documents should be visible and searchable online. This poses technological challenges in the development of infrastructures, skills of staff (to ensure the functioning of the technological system) and students (so they can take advantage of this environment) [9]. The models *Resource allocation and distribution: OERAD* [68] and *Digital Library of Educational Resources and Services* [69] are contributions of the literature towards the evaluation of the dimension **resource allocation**, focusing, respectively, in the interaction users/ resources/ repositories in a networked environment and in the Learning Objects/ Resources and Educational Services.

The tenth dimension of the ELQ model is a **holistic approach to quality aspects**. The ten dimensions of ELQ are part of a puzzle in which all the parts fit. When one of the dimensions changes, that is reflected in all others, requiring a realignment of the system. Rubio [30] divides the models with a focus on a global evaluation in two major groups: i) evaluation and quality management, supported in the existing paradigms of complexity, where a global and comprehensive approach is valued. This organizational strategy is a management methodology that wants all members of the organization to participate in the aim of constant growth of quality [71-75]; ii) based on benchmarking, which allows the organization to be compared with another, using standard criteria, with the purpose of obtaining external certification of quality [73].

5. Procedures to build and operate an evaluation model of TELE

An evaluation system should answer and reconcile two objectives: i) to provide relevant information as well as information comparable with external realities. In the case of TELE in HEIs, there are several European organizations which provide guidelines for the evaluation of quality and improvement of practices, as in the cases of the *European Foundation for Quality in E-learning* (EFQUEL), the *European Distance and E-learning Network* (EDEN) and the *European Association for Distance Teaching Universities* (EADTU). Here, we are talking about benchmarking, a process of identifying the best practices and its contextualization in standard international criteria, with the aim of promoting it through marketing techniques in order to increase the visibility and competitiveness of the HEI ii) to create a way for monitoring the overall goals of the organization (dimension 10 of the ELQ model) or specific dimensions (dimensions 1-9 of the ELQ model) [6].

The characteristics which the indicators of an evaluation model must follow are listed in literature: relevance; capacity to summarize information without distorting it; a structured and multifaceted nature, allowing it to be linked to other indicators resulting in an across-the-board analysis of the system; precision and comparability; reliability and accuracy; timeliness (it should present information on recent years in a timely manner). This means that the evaluation model should: measure the work to be done in order to meet a given objective; identify problematic or unacceptable situations; respond to policy concerns and to the questions that led to its being chosen as an indicator; compare its current value to a reference value, a standard value, or its value over a different observation period [6].

Ten steps are considered fundamental in the development of the evaluation model i) identify or define objectives; ii) create a list of 'policy' issues based on the objectives, iii) develop a list of indicators, iv) list the data required to calculate the indicators; v) locate the data sources available; vi) calculate the indicators; vii) verify the result; viii) analyse the indicators; ix) select the final indicators for the system; x) select the layout of the indicator system document [6].

Conclusions

The new social demands and rapid technological changes require new ways of organizing the institutions. The learning organizations, with flexible structures and channels of communication, where there is a distribution of the power of decision-making through all levels, in which there is a valorization of systemic thinking, where everyone is able to understand the common goal and to collaborate, will have competitive advantages in a world of fast changes.

In the development of TELE by IHEs there are two major factors that justify the implementation of a 2.0 organization: the academic training of the actors, which should be capitalized at critical mass for the development of TELE and the fact that the components of these environments are "permanent white waters" and at the same time, fundamental for the adequacy and quality of the service provided by the IHEs.

In addition to organizational aspects, in the development of a TELE it is necessary to ensure a mechanism of evaluation that ensures the quality and works as a guide of action. The ELQ model [9] is an important contribution of the literature, to the extent that, based on documents produced by national and international organizations coupled with the hot topics that exist in the literature, identifies the critical dimensions of the TELE, articulating a holistic view with a detailed analysis of the different dimensions.

Going through the ELQ model, we can frame some existing models of evaluation more meaningful in each of the ten dimensions. It is intended that the matrix built this way can be a guide, so that each organization can define its own policies and its own evaluation models, under the TELE.

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