Process-Oriented Quality in e-Learning: A Proposal for a Global Model

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ABSTRACT Nowadays, all the universities that offer courses in the e-learning modality seek to improve and differentiate more and more from their competitors. One possible way forward is without doubt to implement standards and good practices. These allow us to guarantee the quality in the implementation or maintenance of the entire e-learning system. The problem is the diversity of existing standards and good practices because they can generate confusion in the selection of the most appropriate. The ideal would be to have a global quality model so that it would be easy to identify what is really needed to implement, maintain, ensure or adequately compare quality across all universities, regardless of their geographical location. In this work, an initial proposal of such a model is presented. In this sense, a set of 15 standards and good practices from all the continents were studied, using a quantitative and qualitative methodology. As a result, this proposal had a total of 15 dimensions and 93 criteria, and it was verified that no standard or good practice encompasses all the criteria. This initial model was validated by the opinion of experts through an on-line questionnaire. Taking into account the results of this validation, the proposed model was divided into three basic groups according to the importance of the dimensions, and in turn divided into other three groups according to the importance of the criteria, structured as a pyramid of levels, where the top or core model consists of 5 dimensions and 9 criteria. This proposal for a global model helps all who are interested in quality in e-learning to make decisions to improve or adjust the entire educational process in a university or teaching institution.

INDEX TERMS E-learning, quality assurance, quality, standardization, process-oriented.

I. INTRODUCTION

Quality in education can be understood as a set of attributes or characteristics, selected to evaluate the service, which affects customer satisfaction, either explicitly or implicitly [1].

In education, the "client" is the student, business, society, and government [2] while the service provider is the university.

A university with quality means that, in addition to being certified in some standard, society recognizes it as being very useful in the training provided, that is, it satisfies the demands of the labor market, the economy and the citizens in general [3].

As e-learning is a teaching modality aligned with the goals set by the Bologna process, quality is one of the essential

The associate editor coordinating the review of this manuscript and approving it for publication was Francisco J. Garcia-Penalvo[ID].

parameters for any university and has a huge impact on the satisfaction of all stakeholders [4], [5].

Therefore, support for standards must be taken into account [6], [7], since implementation and accreditation in a standard means that the university meets all the requirements of this standard [8] and provides a framework for the presentation of data in a comparable and comprehensive manner [9].

One of the methodologies found for the quality of e-learning is process orientation [10]–[12], this methodology helps teaching institutions to implement quality in a structured way, so that they can develop and deliver the e-learning [13], since it focuses on phases such as planning, analysis, design, prototyping, and post-production [14].

The process approach improves the effectiveness and efficiency of the educational institution in achieving its objectives to improve customer satisfaction, taking into account its requirements [15], that is, a sequence of activities duly

organized and managed in a way to create value to the customer and other interested parties [16]. These activities are described in detail in procedures, which describe the specific form and method to perform a given activity [17], that is, know how to do [18].

For this reason, a great number of standards and good practices (specifications from now on) have been constructed to be used in this modality of teaching [19].

With so many specifications available, with different geographical areas of action and with different properties each of the specifications, it is difficult to compare different universities globally from the point of view of process-oriented quality.

The ideal would be to have a single model [20] (or specification) with well-defined categories (they will be characterized in the next sections as dimensions and criteria) to ensure process-oriented quality in all universities around the world. This is the objective of this work: to help define this unique model.

In this sense, this paper completes the work initiated in 2012 [21] and is based on a literature review of fifteen standards or specifications from around the world. A total of 112 dimensions and 409 criteria were initially identified, and after studying them, they were refined to a first model of 15 dimensions and 93 criteria. Later, this initial model was validated with the opinion of experts in this field, and a more elaborated classification of these dimensions and criteria arose.

The rest of this paper is organized as follows. First, in section II, the importance of process-oriented quality is showed. In section III, the selected agencies together with the methodology used to select them are described. In section IV, the dimensions and criteria obtained in this study are explained, along with the methodology used to identify them. In section V, the validation of the previous section by experts using an online questionnaire is stated. In section VI the results of the questionnaire from the previous section are discussed, and a proposal of a structured model is presented. And finally, in section VIII the conclusions of this study are presented.

II. BACKGROUND

A process is a set of inter-related activities that require resources such as people, materials, and equipment so as to transform inputs into outputs, and add value to input data [22].

In education, a process is described according to the same principles, i.e. a student receives inputs that produce a transformation of personality (known as immature) and the output is the knowledge gained (mature personality) [23].

The same definition can be applied to e-learning (as an initial process which is then split into sub-processes) in as much as the basic inputs (composed of knowledge, experience and curriculum/subject matter), combined with the suppliers (teachers, trainers, technicians and other specialists in the field) are transformed (influenced by external factors such as human resources, material resources, performance and progress) into outputs (training sessions, evaluation, analysis and other information) for the clients who are the students [24].

Initially the process-oriented standards were created for the industry and later, they were adapted to the teaching with great success. Examples are Total Quality Management (TQM) [25], Six Sigma [26], European Foundation for Quality Management (EFQM) [27], Malcolm Baldrige [28], Deming [29] or International Organization for Standardization (ISO) 9000/9001 [30].

These standards and good practices have been useful in several areas of action, according to their needs, for example, for universities these standards are relevant in management and continuous improvement, since, these processes allow to evaluate the work done by teachers, evaluate students' learning, analyze customer satisfaction (students, companies, and government) and make teaching available as a service.

However, the standards and good practices presented above are classified as "general process-oriented" [31], insofar as they are not specific to e-learning.

But there are standards and good practices "oriented to specific processes for e-learning" [31] and are the ones that we must take into account for this study.

We can find some examples of the application of process-orientation in the literature, of which we will describe the most representative.

In the field of management, process-oriented methodology improves organizational performance [32], permits long-term sustainability, and facilitates continual improvement and optimization of the entire organization [33] and the capacity for a fast response to the client, rapid adaptation of services to the changing requirements of clients and resulting reduction of costs [14].

In the field of teaching/learning, process-orientation achieves better results in comparison to other methodologies because it helps to develop activities for students based on a group of (very well defined) inter-related and active tasks, thus promoting better collaboration, critical thinking, problem resolution and interaction [34].

Bonanno [35], proposed a design tool for the development of a course (course content, methodology and evaluation techniques) based on the creation of a process-oriented model. According to the author, this tool and model were used to create: evaluation instruments for complex pedagogical scenarios, physical infrastructure, resources and course models.

A comparative study of process-orientation and product-orientation showed that process-orientation is more efficient in distance teaching and learning because it promotes an environment of social learning inclined towards constructivism, an inclination towards flexibility and control of the student, whilst product-orientation is inspired by technology and increased production of learning materials which do not show improved learning results [36].

Another study along these comparative lines demonstrates the advantages of using process-orientation rather than product-orientation in the growth of knowledge in children

because product-orientation focuses on results, knowledge, and skills, whilst process-orientation allows for learning through problem resolution and discovery [37]. The benefits for students using a process-oriented model to learn English as a second language led Piggin [38] to conclude that this methodology encourages better motivation in the students during learning. In terms of student performance, process-orientation, when compared to traditional models, shows that this is not only based on the results of exams/tests but also on their performance in carrying out learning tasks, making the evaluation more efficient [39].

For teachers, process-orientation led to the development of software (T-CMM – "Trusted Capability Maturity Model", based on CMM/CMMI – "Capability Maturity Model/Capability Maturity Model Integration") that permits individualized, systematic and incremental teaching, so as to achieve excellence in higher education [40].

Process-orientation is also useful for teachers teaching in groups, where the teacher plays the role of moderator and facilitator of learning, encouraging students to reach their potential, stimulating their ability to respond, and thus making the participants feel that they are part of a community, which in turn promotes emotional security, improved personal growth and increased competence [41]. Process-orientation is also present in: a) techniques such as POGIL (Process Oriented Guided Inquiry Learning) [11], which aims to develop skills such as critical thinking, problem resolution and communication through cooperation and reflection, giving immediate feedback to teachers on what the students do and do not understand, and emphasizes that learning is not a solitary exercise in memorizing information but an interactive process of comprehension and the development of capabilities [42]; b) the CoI model (Community of Inquiry Model) which is an investigative education community which uses a collaborative-constructionist approach to acquire knowledge through the development of the following elements: social presence, cognition and teaching [42]; c) highly positive and encouraging results are also presented in the field of process-oriented translation cognitive models, where the objective is a constructivist translator trainer in e-learning so that the student can acquire knowledge [43] and [44].

Other important examples are the case of Lewis [45] which emphasizes the importance of the Quality Assurance Agency for Higher Education (QAA) standard since it allows greater rigor in the approval, management and monitoring of courses for three purposes: public money, quality assurance in learning and sending information to employers. The quality culture employed in Scandinavian educational institutions is referred to as an added value by Paulsen and Rekkedal [46] based on the National Association for Developmental Education (NADE). The Open & Distance Learning Quality Council standard (ODLQC) has proven to be useful at the pedagogical level, particularly in the adult-tested PBL model by Hurst and Quinsee [47]. The Japan University Accreditation Association (JUAA) has helped the Japanese higher education system to move from quantitative to qualitative in many areas of university management such as human resources, strategy, course curriculum, course management and admission policies [48]. The recommendations of the Institute for Higher Education Policy (IHEP) and the Council of Regional Accrediting Commissions (C-RAC) were the basis for improving educational institutions, namely, teacher work and student learning. Through these two recommendations there was a reinforcement of the organizational structure with well defined responsibilities, specific activity sectors (e-support, faculties, executive board, project manager, flexible learning), implementing an intrinsic motivation, reinforcing academic incentives and providing training more suitable to the teachers who improved their work a lot and, consequently, the learning became easier for the students [49]. The Center for Higher Education Development (CHED) has made a significant contribution to the modernization, efficiency, and quality of the education system in the Philippines, particularly in the quality culture [50].

III. AGENCIES
A. METHODOLOGY

After identifying the group that we intend to study (specific processes of e-learning), realized in previous work [21], it is necessary to find a set of agencies that have standards or good practices and that are in this group.

These agencies, in addition to having standards or good practices, must comply with the following requirements: i) focused on evaluating the quality in e-learning at the process level, in higher education; ii) applied to the modality of e-learning or adapted, in this case, they should mention in their content that they are adapted; iii) publicly available for consultation through a website; iv) at least one agency per continent (Europe, Asia, America, Africa and Oceania); v) the set of all standards or best practices selected should take into account at least the point of view of educational institutions, students, and teachers; vi) the agencies should be relevant to this study.

Relevance is the central concept in information science because of its importance for research in the field of documentation, general information and scientific information [51], that is, the result of research on the subject to be investigated has at least one important component of information contained in the documents consulted and which enables the respondent to assist the investigation [52].

Considering the previous requirements, a set of fifteen agencies with its corresponding standards and good practices were selected from the five continents. They are presented in table 1.

The inclusion of five continents facilitates comparisons between standards and good practices, identifies gaps in a more comprehensive sample, allows a generalization of results and for this reason allows a broad analysis of data through the creation of a framework with categories [53], [54].

TABLE 1. Agencies for continents.

Acronym	Name
	EUROPE
QAA	Quality Assurance Agency for Higher Education
NADE	National Association for Developmental Education
ODLQC	Open & Distance Learning Quality Council
OAQ	Quality Assurance in Higher Education
	ASIA
JUAA	Japan University Accreditation Association
DEC	Distance Education Council
MQA	Malaysian Qualification Agency
CHED	Centre for Higher Education Development
	AMERICA
IHEP	Institute for Higher Education Policy
C-RAC	Council of Regional Accrediting Commissions
AFT	American Federation of Teachers
MEC/SEED	Ministério da Educação/Secretaria de Educação a Distância
	OCEANIA
AQA	Academic Quality Agency
TEQSA	Tertiary Education Quality and Standards Agency
	AFRICA
NADEOSA	National Association of Distance Education Organizations of South Africa

B. SELECTED AGENCIES

In this subsection, the selected agencies, following the requirements mentioned above, together its mission are shown. This component is of great importance in that the mission corresponds to what the agency intends to do and for what it is intended [55]. It is the purpose of the agency's existence [56] and guides a strategic plan that is reflected in its standards or good practices [57].

The selected agencies are:

1) QAA: QUALITY ASSURANCE AGENCY FOR HIGHER EDUCATION

QAA is an independent quality assurance agency for Higher Education created to provide a standard for the United Kingdom [58]. Its responsibility is to monitor, ensure the implementation of this standard, provide information to associates and associate candidates [59], publish quality reports, support counselling and guidance to educational institutions and members, improve the quality of education in the Kingdom and ensure that the student's learning experience is of high quality [60].

2) NADE: NATIONAL ASSOCIATION FOR DEVELOPMENTAL EDUCATION

NADE develops quality guidance in distance education including e-learning [61], guarantees the improvement of the education of students at all levels and the professional capacities of teachers [62].

3) ODLQC: OPEN & DISTANCE LEARNING QUALITY COUNCIL

ODQLC is an organization founded at the request of the UK Government to advise, support and use reliable and coherent methods for higher education institutions to identify and improve quality in the EAD [47]. It disseminates and promotes quality through a set of standards [63].

4) OAQ: QUALITY ASSURANCE IN HIGHER EDUCATION

It is headquartered in Switzerland and is responsible for accrediting and auditing quality in higher education using developed procedures and standards. It has to monitor, ensure and promote the quality of teaching and research in higher education institutions, [64].

5) JUAA: JAPAN UNIVERSITY ACCREDITATION ASSOCIATION

JUAA was established as a voluntary organization, but currently promotes the qualitative improvement of higher education institutions [65]. It ensures that evaluations and accreditations are implemented since it is mandatory in that country. It also ensures and improves the quality of academic activities [66].

6) DEC: DISTANCE EDUCATION COUNCIL

DEC aims to provide education for all so that the students can become leaders and innovators, and it has a responsibility for the coordination, promotion, and maintenance of quality standards in EaD in India. All higher education institutions should have these standards as a basis for evaluation [67].

7) MQA: MALAYSIAN QUALIFICATION AGENCY

MQA ensures quality in higher education based on its standard, promotes good quality practices described in it, monitors its implementation and evaluates educational institutions periodically [68].

8) CHED: CENTRE FOR HIGHER EDUCATION DEVELOPMENT

Created in the Philippines, CHED strives to build human capital with the capacity to innovate and develop the nation by promoting the quality of standards-based education, ensuring quality and protecting academic freedom so that it can continue to grow in terms of responsibility, advancement in research, leadership development, and enrichment of historical and cultural heritage [69].

9) IHEP: INSTITUTE FOR HIGHER EDUCATION POLICY

IHEP is a nonprofit US agency that develops orientations to meet the country's major education challenges. Its mission is to improve access to university and the success of higher education for all students (with attention to the neediest populations) [70]

10) C-RAC: COUNCIL OF REGIONAL ACCREDITING COMMISSIONS

CRAC is a US regional accrediting agency created to improve the quality of e-learning programs. It promotes

educational effectiveness, promotes distance education planning, and credits the grant to other agencies based on their standards [71].

11) AFT: AMERICAN FEDERATION OF TEACHERS

AFT is an agency based in the USA and aims at the practice, policy, and defense of technology-assisted learning. Its mission is to give voice to its professionals, to strengthen the institutions where they work, to improve their quality of services, to promote democracy, human rights and to help members in the Division of Higher Education. It works mainly on issues related to EaD and technology, encouraging its members to take an active role in educational technologies in educational organizations. Based on a large-scale survey, it created a standard [72].

12) MEC/SEED: MINISTÉRIO DA EDUCAÇÃO/SECRETARIA DE EDUCAÇÃO A DISTÂNCIA

Created in Brazil, it aims to contribute to the inclusive development of education systems. Its mission is to promote inclusive education, human rights, and socio-environmental sustainability through a guide of good practice that assesses quality for distance learning in higher education [73].

13) AQA: ACADEMIC QUALITY AGENCY

AQA is an agency based in New Zealand, which aims to ensure, improve and disseminate academic quality in universities. To this end, it promotes quality through a set of good practices [74].

14) TEQSA: TERTIARY EDUCATION QUALITY AND STANDARDS AGENCY

This Australian agency regulates and guarantees the quality of higher education (public and private), registers and evaluates the performance of educational institutions. It does not have a special section of distance education, but its standards have a description that informs the reader about its application in all modes of education [75].

15) NADEOSA: NATIONAL ASSOCIATION OF DISTANCE EDUCATION ORGANISATIONS OF SOUTH AFRICA

NAEDOSA was established in South Africa and has created a standard that facilitates collaboration between distance learning and open learning organizations. It promotes and improves quality assurance, the interests of professionals, research, evaluation, understanding, and application of distance education [76].

IV. DIMENSIONS AND CRITERIA
A. METHODOLOGY

After identifying the fifteen agencies, the next step is to analyze the content of its corresponding standards and good practices, and identify a set of dimensions and associated criteria. In this context, the importance of a qualitative research perspective [77] added to an empirical basis is necessary [78].

In a worksheet, phrases that are part of the description of the standards were introduced, which resulted in a list (inventory) [79].

Subsequently, the data contained in the list were divided into units of analysis, that is, key points (grouped according to themes/categories) to be openly questioned and to identify similarity relationships so that they could be easily managed and interpreted [53], [80].

As a result, a set of categories in which each category has inside the key points was obtained. These categories were named dimensions and their content was named criteria.

B. RESULTS

Originally 112 dimensions were identified, studied and refined. Once applied the method described above, the result was the identification of 15 dimensions that can be seen in table 2. The first column shows the name of each dimension, and the first row shows the name of each continent with their corresponding agencies.

It is clear that the standard/good practice of the agency NAEDOSA (from the African continent) is the only one that encompasses all the dimensions (but this doesn't mean that it also includes all criteria, as it can be seen in the next section). On the other hand, the standard/good practice of NADE (from the European continent) is the one that covers fewer dimensions.

The next stage was the identification of the criteria, which are part of the central category obtained, the "dimension"; and there is a relationship with its content (previously grouped), which allows constructing a hierarchical structure (Dimension -> Criteria) [87].

Originally, 409 criteria were identified, studied and refined in a similar way to what was done with the dimensions. The result was a set of 93 criteria classified into the 15 dimensions.

The content of each dimension and its corresponding criteria are described below:

1) ACCREDITATION

This dimension is composed of a single criterion, that can be seen in table 3 with the respective agencies from which they come. For the sake of clarity in this table and in the following ones, the agency corresponding to each criterion will be shown indicating the concrete bibliographic reference.

The criterion is:

a) Accreditation. An institution obtains an accreditation in one determined area when it fulfills successfully all the requirements specified by a quality agency. These requirements may be for example, objectives, processes or curricula.

2) ASSESSMENT

This dimension is composed of nine criteria (table 3):

a) Administrative staff. It must receive specific training and be evaluated periodically so as to measure their performance.

TABLE 2. Distribution of dimensions by agency and continent.

Dimensions	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Accreditation	√		√		√										
Assessment	√	√	√	√	√	√	√	√	√	√	√		√	√	√
Course	√	√	√	√	√	√	√	√		√		√	√	√	√
Digital learning materials	√			√	√		√		√						√
Ethics	√		√						√				√	√	√
Institutional	√		√			√	√	√	√	√	√	√	√	√	√
Laws	√		√			√				√	√		√		
Non-educational resources	√		√	√	√	√	√	√		√	√	√	√	√	√
Pedagogy	√		√	√	√		√	√				√	√	√	√
Public information	√	√	√	√	√	√	√	√	√	√	√		√	√	√
Quality culture	√	√	√			√	√	√	√		√		√	√	
Security	√		√		√		√	√					√		√
Students	√	√	√	√		√	√	√	√	√		√	√	√	√
Support	√	√	√	√	√	√	√	√	√			√	√	√	
Teachers	√		√	√	√	√	√	√	√			√		√	

TABLE 3. Criteria for accreditation and for assessment.

	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
CRITERIA FOR ACCREDITATION															
Criteria	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Requirements	[76]		[71]		[72]										
CRITERIA FOR ASSESSMENT															
Administrative Staff								[68]							
Courses	[76]		[71]					[68]						[74]	[75]
Evaluation methods								[68]							
Formal learning	[76]		[71]	[73]	[72]		[67]	[68]		[60]			[63]	[74]	[75]
Informal and Non-Formal Learning	[76]														
Organization	[76]	[70]		[73]		[66]						[62]			
Potential Projects			[71]												
Teachers	[76]				[72]										
Student feedback and Complaints	[76]						[67]		[69]	[60]				[74]	[75]

b) Courses. For a course to come to or continue to be respected there must be a mechanism for evaluation, self-evaluation, monitoring and revision of the course and its objectives through data analysis, feedback received (from as many interested parties as possible) and through benchmarking, in order to try to improve performance. The course must be regularly evaluated by sufficiently qualified persons.

c) Evaluation methods. Different methods and tools can be used as long as there exist mechanisms to ensure validity, reliability, consistency, equity, and procedures for the realization of exams, feedback to students and procedures for appeal.

d) Formal Learning. The evaluation must be a continuous process, involving a variety of methods and tools. It should at least include: (i) the student's performance, (ii) efficiency, (iii) interaction, (iv) quality of work and tasks, (v) relevance of the quality of learning, (vi) comparison of internal results, (vii) comparison with results of other teaching institutions, (viii) self-evaluation, (ix) evaluation of tutors and (x) evaluation by peers. Furthermore, the student's progress must be monitored. The student completes

TABLE 4. Criteria for course, for digital learning materials, and for ethics.

CRITERIA FOR COURSE

Criteria	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Adaptation										[60]			[63]		
Approval	[76]				[72]		[67]			[60]				[74]	[75]
Credits	[76]	[70]					[67]					[64]			[75]
Course quality guarantee	[76]		[71]							[60]		[64]			[75]
Development	[76]	[70]	[71]	[73]	[72]	[66]	[67]	[68]				[64]			[75]
Efficacy			[71]												
Management			[71]	[73]	[72]	[66]		[68]		[60]				[74]	
Marketing the course	[76]												[63]		[75]
Monitoring				[73]						[60]			[63]		
Structure		[70]	[71]					[68]				[64]	[63]		
Transfers					[72]									[74]	[75]

CRITERIA FOR DIGITAL LEARNING MATERIALS

Availability	[76]						[67]		[69]						
Development and planning	[76]			[73]			[67]		[69]						[75]
Life cycle	[76]								[69]						
Re-use					[72]										
Tests	[76]						[67]								

CRITERIA FOR ETHICS

Institutional													[63]		
Legal issues	[76]		[71]						[69]					[74]	[75]

the course successfully when they achieve the necessary credits [89].

e) Informal and non-formal learning. There must be a recognized and effective system to evaluate informal and non-formal learning (a prospective student's previous experience and experience gained during the course, work placements or on the job training, practical work or partnerships with industry – peer evaluation). They must have procedures for transforming informal and non-formal knowledge into formal knowledge (credits). Motivation and strategies for progression must also be in place [90].

f) Organization. The evaluation of a teaching institution should consider at least the following: (i) feedback received and respective levels of satisfaction, (ii) self-assessment, (iii) existing procedures within the organization to carry out this self-assessment, (iv) external evaluation, (v) results of student performance exams, (vi) relevance to businesses of the quality of students' learning, fulfilling of the institution's mission, and (vii) attaining its objectives. Additionally, it is important to consider if the following is being fulfilled: (viii) all participants are involved in continuous improvement, (ix) the number of students is sufficient to maintain the course

active, (x) financial results are sufficient for maintenance and (xi) investment, taxable income is being retained, and feedback received is used for continual improvement [89].

g) Potential projects. The institution must be alert to, evaluate and give priority to potential and innovative projects related to the area of interest, and should sponsor them.

h) Teachers. The entire teaching body must be evaluated periodically, including the quality and standard of teaching by teachers and tutors, training received, sharing of their scientific knowledge and involvement in research projects.

i) Student feedback and Complaints. Feedback should be a motivational element for improving the course, curriculum and teaching/learning practices. Furthermore, complaints and appeals must be analyzed impartially and formally registered according to pre-existing procedures within the institution and with protection for the complaining student.

3) COURSE

This dimension is made up of eleven criteria (table 4):

a) Adaptation. The course must begin at a specified level, which must be known by the student. In order to achieve

this, before the course begins there should be a period of orientation for the students that includes an orientation with respect to method, model and technologies.

b) Approval: the competent external authorities, for example, government, must approve all courses offered by the teaching institution. The institution must be rigorous and consider the type of teaching offers. Therefore, the courses must be approved internally, based on: (i) educational principles, (ii) requirements of relevant bodies, (iii) revision carried out, (iv) feedback obtained, (v) lawful verification, (vi) evaluation/re-evaluation by the teaching body, and (vii) as recommended by external bodies as appropriate and respecting copyright.

c) Credits. Student mobility can only be achieved via recognition of qualifications and enrolment of new national and foreign students if a system of credits is implemented for the courses.

d) Course quality guarantee. The existence of a quality guarantee in a teaching institution implies that the institution assumes responsibility for ensuring quality standards, and as such supervision and the academic plan must be aligned. Certificates must be appropriate to the level of graduation, and decisions and responsibilities must be communicated to all involved, which leads to active participation. If the teaching institution due to a legal or other issue interrupts a course, it must pay attention to fulfilling the commitments originally made to the students. There must be clear and efficient processes for guaranteeing course quality.

e) Development. The development of a course must include at least the following project phases: (i) analysis, (ii) planning, (iii) testing, (iv) evaluation and (v) maintenance. During these phases, the market needs, the objectives, strategy, vision mission and plans of the institutions should be taken into account.

f) Efficacy. The efficacy of a course is the measure of: (i) the comparison between objectives and the students' results, (ii) errors in materials supplied to students, (iii) course cost-benefit, (iv) students' objectives, (v) inquiries realized, (vi) satisfaction of students measured by regular inquiry, (vii) competencies and capacities of students, (viii) rate of retention and (ix) resources used for learning.

g) Management. Tasks relating to the management and supervision of a course must include the management of: (i) the teaching process, (ii) the evaluation of learning, (iii) the number of teachers available relative to the number of students, (iv) the distribution of pedagogical materials, (v) managing the data base of collaborators assigned to the course, (vi) academic requests, (vii) the training needs of teachers, (viii) evaluation records, (ix) the academic quality guarantee, (x) the planning, development and monitoring of academic activities, and (xi) the course equipment.

h) Marketing the course. Marketing material should present clear, transparent, truthful, up-to-date and precise information about: (i) the course, (ii) its objectives,

requirements, expected results and how to achieve them, (iii) who the teachers are, (iv) teaching and learning strategies, (v) admission requirements, (vi) learning environment, (vii) course modules and (viii) agreements involved.

i) Monitoring. The institution must monitor a course once approved, which will generate an analysis document. Monitoring collects feedback, evaluation methods, requirements for learning materials and teaching strategy.

j) Structure. A course's curriculum is part of its structure and must be recognized by companies or organizations. A course's structure must respect national and international law, objectives, learning materials and resources.

k) Transfers. The organization must have mechanisms in place for transferring national and international students, and must refer decisions about recognizing qualifications to the responsible department. The teaching body should evaluate the recognition of qualifications.

4) DIGITAL LEARNING MATERIALS

This dimension is composed of five criteria (TABLE 4):

a) Availability. Learning materials must be permanently available. The ways in which digital learning materials are available must be communicated to students in an objective and clear manner, and there must be monitoring of the information sent to students so as to be aware of failures in providing learning materials.

b) Development and planning. Materials must not contain spelling mistakes, must be well structured, page numbered, must have a common format and layout, must have content which is adequate for the theme, respect copyright, use clear language to explain content, be tailored to the learning result envisaged and must have an appealing and motivational introduction [89].

c) Life cycle. There must be a periodic revision of materials, at least every five years, or based on feedback, or with regards to advancements in knowledge.

d) Re-use. It allows for materials to be used in various contexts and for different ends, therefore the production team must produce learning materials that can be easily updated and re-used maintaining the same level of quality.

e) Tests. They are conducted to eliminate defects. Learning materials must be tested before being made available, and also afterwards based on feedback.

5) ETHICS

This dimension is composed of two criteria (table 4):

a) Institutional. The institutions must inform as to which areas are recognized and which are not. When marketing courses, the teaching institution must declare whether it is a higher education course or another kind of course, as it is important to know whether the course counts as an academic qualification or professional qualification.

b) Legal issues. It is the responsibility of the teaching institution to comply with laws and regulations, carry out effective management and communicate the state of the

TABLE 5. Criteria for institutional, for laws, and for non-educational resources.

CRITERIA FOR INSTITUTIONAL

Criteria	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Administrative council	[76]					[66]	[67]	[68]	[69]						[75]
Analysis of results							[67]	[68]							
Installations, equipment and other infrastructure	[76]							[68]						[74]	[75]
Management software	[76]						[67]	[68]							
Marketing		[71]													[75]
Mission and vision	[76]	[71]					[67]		[69]			[64]	[63]		
Objectives								[68]		[60]	[62]	[64]			
Research policies							[67]	[68]						[74]	[75]
Service provision contracts	[76]	[71]											[63]	[74]	[75]
Social, professional and academic context						[66]						[64]			[75]
Strategy	[76]					[66]	[67]			[60]		[64]		[74]	
Transfer and exchange policies		[71]						[68]							[75]

CRITERIA FOR LAWS

Criteria	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Laws	[76]	[71]				[66]				[60]	[62]		[63]		

CRITERIA FOR NON-EDUCATIONAL RESOURCES

Criteria	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Facilities		[71]				[66]	[67]					[64]			[75]
Financial	[76]	[71]	[73]			[66]	[67]	[68]		[60]	[62]		[63]		
HR/general	[76]	[71]	[73]	[72]		[66]	[67]	[68]					[63]		
HR/personal development							[67]							[74]	[75]
HR/promotions	[76]							[68]							
HR/recruitment	[76]					[66]	[67]	[68]				[64]		[74]	
HR/training	[76]	[71]			[72]		[67]				[62]	[64]			[75]
Quality resources											[62]				

institution. It must also implement a policy to combat plagiarism and in this way comply with the current legislation on copyright, whether in students' work or in the compilation of teaching materials [89].

6) INSTITUTIONAL

This dimension is composed of twelve criteria: (table 5):

a) Administrative council. It is responsible for policy making, finances, leadership, and building an organizational structure based on the e-learning teaching system. It has the responsibilities associated with the mandate: (i) channels of responsibility between government and community and social structures, (ii) promoting meetings, (iii) transmitting functions to teaching staff, (iv) managing communication and information systems effectively, (v) managing external relations, (vi) responding rapidly to requests, (vii) fulfilling procedures, (viii) responsible within management and improvement, and (ix) rules for achieving mission and objectives.

b) Analysis of results. It refers to: (i) skills expected of the student at the end of the course, (ii) skills necessary for a professional career, consultancy, research and patents, community service and institutional development carried out, relation between evaluation made and the results of learning, and prizes given versus prizes received.

c) Installations, equipment and other infrastructure. All infrastructure must: (i) comply with health and safety laws, (ii) be adequate for formal and informal learning, (iii) be easily accessible, (iv) be equipped with up-to-date technology and (v) be regularly evaluated. Further, there must be a procedure that establishes alternative plans and recovery options in the event of a failure, so as to ensure the continuity of teaching and learning.

d) Management software. There must be adequate management software to maintain up-to-date detailed data, including information on students, teachers and tutors, course results and other management information. The information on students should include: (i) personal data, (ii) admissions, (iii) register of attendance, (iv) register of progress, (v) financial information, (vi) monitoring of financial transactions, (vii) evaluation methods, (viii) evaluation results, (ix) evaluation criteria, (x) scholarships given, (xi) register of research work done, (xii) guidance given to students, (xiii) online operations made, (xiv) suggestions, (xv) complaints by students, (xvi) decisions made and (xvii) enquiries.

e) Marketing. It should include (i) the intended target market, (ii) the type and model of teaching, (iii) the technology used on the course, (iv) the necessary technical requirements, (v) the entry requirements,(vi) the course content, (vii) the course learning materials, (viii) the student support services, (ix) the fees and payment conditions, (x) the recommended deadline for completing course, (xi) the conditions for interruption or deferral by students, (xii) the agreements with employers or other teaching institutions and (xiii) the factors that facilitate achieving the teaching institution's objectives. The teaching institution must monitor marketing materials used by third parties so check whether the content is truthful and/or whether they are fulfilling established agreements [89].

f) Mission and vision. The institution must define its mission, a vision, a policy and objectives. This means institutional preparation for international contexts, alliances, research, quality guarantee, commitment to educational values, feedback, future plans, and information received from the administrative council. Mission, strategy and courses offered must be in tune [88] [89].

g) Objectives. They should include: (i) focus on course design and management, (ii) research carried out versus research predicted, (iii) the objectives of the society and their clients, (iv) the preparation of students in terms of skills, and (v) social and cultural terms. Every course must be profitable for the student and for society. Objectives must be publicly available [88].

h) Research policies. There must be a programme and policy with standards of excellence aimed at making the link between scientific research, development and sustainable commercialization, based on: (i) available installations, (ii) results obtained, (iii) recognition received and (iv) participation in research-based programmes and teaching.

If the teaching institution receives public funding then it must comply with the requirements of those programs.

i) Service provision contracts. The teaching institution needs to contract other entities to provide products, services, jobs, course offered by more than one institution, work placements or internships and other business. It must take into consideration best practices and applicable laws. In the case of service provision, best practices would be to provide all the necessary information for the partner to be as independent as possible, whilst controlling its activities.

j) Social, professional and academic context. Social contributions must be made by making intellectual resources available, complying with laws and regulations, good financial management, including any of social funds, responsibility, analysis of financial capacity, meeting standards and publicizing the state of the teaching institution.

k) Strategy. In order to achieve the objectives of the course, a decision-making committee must exist, along with a strategy directly linked to each project within the course, to the development of each programme and materials of every course, to the quality guarantee system, and contain student admission requirements, support available to students, the evaluation methodology, marketing plan, the format and content of public information, the nature of collaboration with partners, sufficient financial management and resources for each course, and necessary human and material resource; recognize previous and current learning, and select an official language for each course. This will ensure the conditions for accreditation, research, consultancy and cooperation.

l) Transfer and exchange policies. They include the transfer of students between teaching institutions, which requires articulation between the various teaching institutions and the courses offered so as to facilitate mobility. This process must be clearly documented and divulged, must include the criteria, associated mechanisms, approval and processes with proofs.

7) LAWS

This dimension is composed of one criterion: (table 5):

a) Laws. It implies responsibility and knowledge of the law, specifically the following pillars: agreements between institutions, quality assurance, certificates, necessary facilities, distribution of study material, where the examinations are carried out, where the experimentation is carried out, which companies are involved and what is the role of each company involved, academic management, finances and student rights.

8) NON-EDUCATIONAL RESOURCES

This dimension is composed of eight criteria (table 5):

a) Installations. The institution must ensure that its installations are appropriate for the offered course and the proposed objectives, and that they are adequately maintained.

Such installations may be classrooms, facilities for printing of materials, audio-visual production rooms, furniture, laboratories, internet, library, exhibition rooms, spaces for extra-curricular activities, and sporting activities.

b) Financial resources. A financing plan containing adequate budgets, procedures and standards should be drawn up for accounting. The plan must be computerized and must guarantee: (i) the quality of the course throughout its period of operation; (ii) the necessary investments in a management system, equipment, poles and production of materials; (iii) aligned with the objectives, values and principles of the institution; (iv) a structure that makes decisions on financial resources; and (v) the existence of funds for human resources, for supervision, for experimentation and design methods, and for maintenance of courses and investment in new products and services. Financial plans, irrespective of their activity (education, research or infrastructure), must be managed effectively and audited, as well as revenue and expenditure [89].

c) Human resources (HR), which are divided into five sub-categories:

1. Human resources/general. The institution must have multidisciplinary workers for the courses offered who can plan, manage and implement a course, as such all workers must have the appropriate experience, competence and training for the roles they are fulfilling.

2. Human resources/general. The institution must have multidisciplinary workers for the courses offered who can plan, manage and implement a course, as such all workers must have the appropriate experience, competence and training for the roles they are fulfilling.

3. Human resources/personal development. The institution must have a personal development policy for the career, development and professional growth of its employees. This career development should take into account the research, publications, qualifications, self-assessment and recognition. Personal development should also be the responsibility of the employee.

4. Human resources/training. The institution must have a mechanism for identifying and continuously improving the skills of its workers. The objective is to ensure that all employees have qualifications and specializations in the tasks they perform. Since the qualifications and experience of employees are a very important factor, the educational institution must define and execute a training plan for all employees so that they can update their knowledge. For example, in the case of the teachers the training should cover a component of technical support such as resolution of hardware problems, software, or course design.

5. Human resources/promotions. The institution must have clear documentation, procedures and processes to recognize and reward its employees according to the merit achieved. The reward can be realized through salaries, bonuses or other suitable forms. The

right conditions to achieve this must be provided. For example, through research leave, participation in conferences, publications and sabbaticals for personal development.

6. Human resources/recruitment. The institution must have a human resources area or department with a defined policy and procedures for recruitment and selection. The recruitment policy should take into account the merit, leadership ability, research projects carried out and academic qualifications. It also should involve young graduates, searching for a balance between juniors and seniors.

d) Resources for quality. The institution must ensure that all its resources, such as processes, equipment and employees, focus on and are capable of offering quality education.

9) PEDAGOGY

This dimension is composed of six criteria (table 6):

a) Interaction medium. It refers to the interaction between the different (offline or online web) and the mode of communication (non-synchronous, synchronous or mixed), which has been adopted by the teaching institution for the course and the respective tools chosen to this effect. There must be a document to describe this strategy that must be supplied to the various actors.

b) Learning resources. They encompass digital learning materials, libraries and scientific repositories. They should be rigorous, free of discrimination, adequate for the course, effective and free of errors.

c) Objectives. To achieve the pedagogical objectives, the university should take into account the relationship between students and teachers, the context of the course, the counselling made available to the student, the type of orientation provided to the student, and the progress made by the student.

d) Pedagogical model. It should cover, among others, the following: (i) official language of the course, (ii) laboratories (practical lessons), (iii) method used to stimulate creativity and criticism, (iv) incentivize students to deepen their knowledge, (v) encourage the critical thinking and independent learning, (vi) stimulate multidisciplinary approaches, (vii) identify processes to keep students studying, (viii) create close relationships between students and teachers, and (ix) monitor the rate of success.

e) Supervision. The institution should plan and carry out periodic pedagogical supervision, which must be carried out by suitably qualified persons. This supervision should have: (i) a mechanism to monitor the lessons, (ii) monitor the grades obtained in the works, examinations and tests, (iii) create reports of progression analyzes, (iv) monitor the quality of the research carried out by the students (for example, in which journals can publish), (iv) check the learning objectives, (v) check the study plans, and (vi) check the feedback from students and partners.

TABLE 6. Criteria for pedagogy and for public information.

CRITERIA FOR PEDAGOGY

Criteria	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Interaction medium			[71]	[73]	[72]		[67]	[68]							
Learning resources	[76]		[71]	[73]	[72]								[63]		
Objectives			[71]									[64]	[63]		
Pedagogical model	[76]			[73]	[72]		[67]	[68]				[64]	[63]	[74]	[75]
Supervision	[76]		[71]				[67]							[74]	[75]
Welcome manual			[71]	[73]										[74]	

CRITERIA FOR PUBLIC INFORMATION

Criteria	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Admission and transfers								[68]	[69]					[74]	[75]
Audits	[76]										[62]				
Course	[76]		[71]	[73]	[72]		[67]	[68]	[69]	[60]			[63]		[75]
Evaluations	[76]			[73]			[67]	[68]	[69]				[63]	[74]	
Events							[67]			[60]					
Organizational structure											[62]				
Payments	[76]		[71]				[67]								[75]
Security		[70]													

f) Welcome manual. The students should be issued with a "Welcome manual" before beginning the course, explaining the following: (i) access to all services and support for students, (ii) study plan, (iii) technology used, (iv) forms of interaction, (v) expected challenges, (vi) timetables of all activities, (vii) necessary competencies for the course, (viii) timeframe to finish the course, (ix) associated costs, (x) learning objectives, (xi) obligations and responsibilities, (xii) expectations and (xiii) learning materials.

10) PUBLIC INFORMATION

This dimension is composed of eight criteria (table 6):

a) Transfer and admission of students. The teaching institution must have a policy and clear procedures for the admission and transfer of national and foreign students, and the necessary means to guarantee successful preparation for taking the course.

b) Audits. The public must have access to documents about the teaching institution's policies on quality and the reports of audits, mainly who did the audit, what was audited, what information was requested by the auditors, and the final result of the audit.

c) Course. The information about a course should lay out at least, among others, the following: (i) course description, purpose, and target audience, (ii) course requirements, (iii) necessary means to take the course, (iv) technical requirements, (v) estimated time required, (vi) expected difficulties, (vii) objectives, calendar and timetable, (viii) deadline for students to complete the course, (ix) costs, (x) general course organization, expectations, (xi) evaluation methods, (xii) expected learning results, (xiii) teaching/learning strategies, and (xiv) types of learning resources available.

d) Assessments. The information includes: (i) realization of evaluation events (dates, times, enrolment, locations) and (ii) results and claims of evaluations. Evaluations of a task or test must be communicated before the next task or test is carried out. All information about evaluations must be made available through various means, without errors and within a reasonable time period.

e) Events. Students must be informed, through efficient communication, of all events, including workshops, seminars and discussions, which are relevant to the course, and whether these are regional, national or international.

f) Organizational structure. Basically, there should be information about the "who is who" in the course 63].

g) Payment. The information about ways available to make payments for exams, fees, and others, must be simple, clear and detailed, whether these are made through ATM machines, home banking or other means. The information must be published about all financial aid given to students and sponsorship given by the teaching institution, and criteria for attribution.

h) Security. The security of information (for example the access to the e-learning platform, and the personal data

TABLE 7. Criteria for culture of quality, for security, and for students.

	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
Criteria	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
CRITERIA FOR CULTURE OF QUALITY															
Continuous improvement	[76]	[70]	[71]				[67]	[68]	[69]		[62]		[63]		
Periodic revision	[76]					[66]					[62]				
Research							[67]							[74]	
CRITERIA FOR SECURITY															
Control mechanisms			[71]		[72]		[67]	[68]							
Information	[76]		[71]					[68]					[63]		[75]
CRITERIA FOR STUDENTS															
Admission Requirements	[76]		[71]			[66]	[67]	[68]	[69]			[64]		[74]	[75]
Alumni							[67]	[68]							
Exchange							[67]							[74]	
Identification of talents							[67]							[74]	
Learning/Success			[71]							[60]			[63]		
Learning/Strategy										[60]					
Learning/Support		[70]								[60]					
Obligations	[76]												[63]	[74]	
Representation	[76]			[73]				[68]		[60]					
Rights						[66]									[75]

of students) held by the teaching institution must be guaranteed by rigorous security measures and policies.

11) CULTURE OF QUALITY

This dimension is composed of three criteria (table 7):

a) Continuous improvement. The institution must be capable of internal auditing, and continuous improvement must be in line with its mission, objectives, and principles. It has internal processes that are articulated with external processes, such as responsible agencies or organizations. Continuous improvement must be adequate for the courses offered, be present at all levels of the teaching institution, from strategy to operation, and must include course design and continuous efforts to improve the quality of teaching and learning. It must promote the spirit of improvement by revising its practices and must include all collaborators, teachers, students and administrative staff in an active and participative manner.

b) Periodic revision. There must be a person or sector responsible for regularly managing the revision of the quality control system, and then creating the necessary conditions for improvement. Qualitative improvement is possible with regular audits according to its mission and objectives.

c) Research: To ensure that the discussion of quality is encouraged and open, all courses must include a research theme where the realization of scientific projects is encouraged, and suggestions that may arise should be shared afterward, along with research, discoveries, and results [88].

12) SECURITY

This dimension is composed of two criteria (table 7):

a) Information. The privacy of all information must be guaranteed. This information is made up of appeals, complaints, certification, evaluation and financial processes, personal information of students and workers. As such there must be a policy, procedures and practices to achieve the confidentiality and security of registers

b) Control mechanisms. To avoid fraud, there must be mechanisms that guarantee the identification of the student when they are undergoing evaluation, such as tests and exams online. There must also be software for detecting plagiarism, and mechanisms for detecting false certificates and diplomas.

13) STUDENTS

This dimension is composed of ten criteria (which can be visualized in table 7):

a) Admission requirements. The institution should have clear procedures for verifying whether a student's application (national or international) meets all admission or transfer requirements for a particular course. These requirements include at least the following: (i) skills, (ii) prior knowledge of informal and formal learning, (iii) motivation, (iv) experience with technology, (v) demonstrated learning ability, (vi) relevant academic and professional experience, and (vii) language factors.

b) Alumni. The institution should support an association of old students. With this association, it is possible to hold periodic meetings and debates in order to identify possible contributions that are valid for the overall development of the institution.

c) Exchange. Courses must allow for student exchanges at national and international level. This enriches their responsibility, autonomy, better understanding of the foreign language and other cultures.

d) Identification of talents. The teaching institutions must identify their most talented students and incentivize them with scholarships, prizes and free qualifications.

e) Learning, which is divided into three subcategories:
   1. Learning/Success: The teaching institution must create conditions that favor a successful relationship between all the interested parties: reasonable and just learning, support, sufficient methods, incentives for group work, incentives to publish, invitations to participate in events, incentives to complete courses, incentives for government representation and for students to attend graduation ceremonies.
   2. Learning/Strategy. There must be ways of stimulating students to transmit information effectively in their work, through participation in discussions on various themes as required, or in other important learning moments.
   3. Learning/Support. The institution should provide essential services for the students to carry out their activities, and also support and train the students in how to use these services and/or resources so that they become autonomous learners.

f) Obligations. The student must evaluate the courses, taking into consideration the following factors, amongst others: (i) aspirations, (ii) necessary qualifications and qualifications acquired at the end of the course, (iii) course pre-requisites, (iv) responsibility for resources and equipment, (v) responsibility for infrastructure (if applicable), (vi) necessary requirements, and (vii) necessary capacities.

g) Representation. The institution must create a body that is responsible for "Student Representation" and must also identify the means and ways in which this body is represented. It is important that students are encouraged to participate in this type of programmes that affects their promotion of active citizenship, responsibility and character building [88].

h) Rights. The human rights, safety and well-being of students must be guaranteed by the institution.

14) SUPPORT

This dimension is composed of twelve criteria (table 8):

a) Administrative support is divided into two subcategories:
   1. Administrative production. It is the secretariat, which ensures the monitoring and recording of the following tasks: support to the teacher, the tutor and the student, publish the evaluations, issue certificates and enrollments. The support staff is trained to be helpful and have a good relationship with the clients. Administrative staff should be sufficient for the needs.
   2. Administrative management. It defines the strategy of administrative support to the student for the following services: information, secretariat, requisitions and treasury.

b) Students. There must be a support team for students, with flexible and extended working hours, for example, in pedagogical terms (especially to students with more difficulties and with special difficulties), in cultural or technological terms in order to guarantee an adequate learning.

c) Employment. The institution must have an area or department to analyze the industry needs and market, and the need for hiring students. Self-employment should also be stimulated.

d) Financial/bursaries. The institution should provide scholarships for the most disadvantaged students.

e) Infrastructure. It includes ICT and telecommunications in order to access to: services (such as libraries and repositories), learning materials, the learning platform, the hardware components needed to the course and handling of technology.

f) Institutional. The institution should guarantee that technical and institutional support is sufficient and appropriate to the course throughout the learning process.

g) Guidance, assistance and counselling. The institution must make services available, with flexible working hours, for guidance, assistance, counselling and consultation for the selection of courses, professional career, social support, access to services, complaints, and sensitive issues such as sexual assault and disabilities.

h) Teachers. Support and assistance for teachers must be supplied by a team of technical staff who can give support to the teaching staff's skills and areas, and can make the necessary adjustments to the technology with the minimum possible impact.

i) Programmes/courses. The institution must provide the adequate technical and pedagogical support for teachers and students, for example using internal specialized teams and creation of learning communities for peer support.

TABLE 8. Criteria for support, and for teachers.

	CRITERIA FOR SUPPORT														
Criteria	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
	NAEDOSA	IHEP	C-RAC	MEC/SEC	AFT	JUAA	DEC	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Administrative/management				[73]											
Administrative/production	[76]		[71]	[73]			[67]								
Courses/programmes	[76]														
Employment							[68]	[68]							
Financial/bursaries							[67]								
Guidance, assistance and counselling	[76]		[71]			[66]	[67]	[68]				[64]	[63]	[74]	
Infrastructure	[76]		[71]	[73]					[69]						
Institutional			[71]	[73]									[63]		
Services	[76]		[71]		[72]										
Students	[76]		[71]	[73]	[72]		[67]								
Teachers		[70]	[71]	[73]											
Technical	[76]	[70]	[71]	[73]											
	CRITERIA FOR TEACHERS														
Exchange							[68]					[64]			
Skills and abilities			[71]	[73]	[72]	[66]	[67]	[68]	[69]						
TimeTable	[76]						[68]					[64]		[74]	

j) Services. Precise and useful information and explanations should be supplied for each thematic area. This includes libraries, stores of information, bookshops, forms, enrolments, modes of payments, results of audits and complaints.

k) Technical. It must include infrastructure, hardware and software. It is recommended to have a help desk team that, according to the strategy defined by the institution, should serve students and teachers on an expanded, flexible schedule and solve the problems effectively.

15) TEACHERS

This dimension is composed of three criteria (table 8):

a) Exchange. The courses offered by the institution should allow the sharing of human resources at national and international level.

b) Skills and abilities. The institution must have a teaching staff of quantity and quality, with qualifications and knowledge appropriate to their functions and the courses offered. The faculty consists of teachers, tutors and coordinators. Functions should be defined for teaching, research, academic activities, community service and administrative functions. The skills for the evaluation and development of the pedagogical project encompass not only the educational project itself, but also the use of technology

c) Timetable. The institution must have a timetable for scientific research and a timetable for teaching. The timetable for part-time staff must be specific and documented. Timetabling must guarantee teaching quality and consider the preparation of digital learning materials, time for student support, tutorials, guidance and planning, monitoring and evaluation.

V. SURVEY TO EXPERTS
A. METHODOLOGY

We built an online questionnaire, which we made available to a list of respondents, in order to validate the dimensions and criteria found in the previous section.

We invited to professionals in e-learning and engineering in general to fill out a questionnaire (https://docs.google.com/forms/d/1jFwNZ4-lXB0hjzwUhBTpLbUQ6PZJzugSfLMa6-kt4Xg/edit).

These professionals were contacted through the following mailing lists: the List for the Engineering Technology Division of ASEE (ETD-L@LISTSERV.TAMU.EDU), the list of educational informatics of the ibero-american community (iedist@listas.uvigo.es) and lists of the online journals IJET (http://online-journals.org/i-jet).

The validation questionnaire consisted of three parts with (multiple choice) closed answer questions [91]. All dimensions and criteria questions had five response options in increasing order: "Not Important", "Slightly Impor-
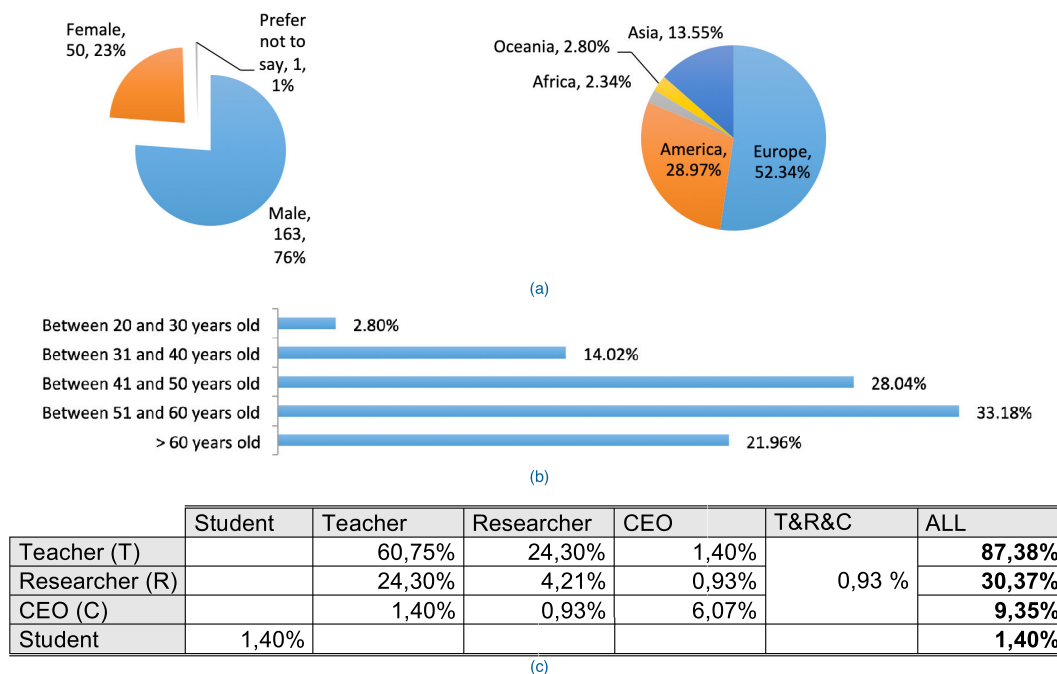
(a)

(b)

	Student	Teacher	Researcher	CEO		T&R&C	ALL
Teacher (T)		60,75%	24,30%	1,40%			**87,38%**
Researcher (R)		24,30%	4,21%	0,93%		0,93 %	**30,37%**
CEO (C)		1,40%	0,93%	6,07%			**9,35%**
Student	1,40%						**1,40%**

(c)

FIGURE 1. Personal data of participants.

tant", "Moderately Important", "Important" and "Very Important".

The first part was relative to the identification of the participants. The second part dealt with the dimensions and the third part (optional) about the criteria of each dimension.

Finally, there were 214 responses for the dimensions' part and 95 also for the criteria part. The survey period was from 01 of June 2018 to 31 of July 2018.

B. RESULTS
The results of the first part (identification of the participants) can be seen in figure 1. In fig. 1.a the gender and geographical distribution is shown. With respect to the gender of the participants, its distribution is typical in engineering, with a low female participation, close to 25%. With respect to the distribution by continents, the greatest participation of Europe can be appreciated, followed by America. In fig. 1.b the age distribution is shown, where it can be seen that the majority of the respondents are between 40 and 60 years. In figure 1.c the dedication of the respondents is shown. These could indicate more than one option, so the intersection of each row and column shows the percentage of respondents who indicated those two options. In a separate column is the option of those who answered to the three options (T&R&C): Teachers, Researcher and CEO (Chief Executive Officer). It can be seen that most of the respondents (87.38%) are teachers.

The results (in percentage) of each dimension can be seen in figure 2, where dimensions are ordered by the percentage of "Very Important" responses: at the top, it is the dimension

with the lowest value of the percentage of "Very Important" responses and at the bottom the one with the highest value. According to the percentage of "Very Important" responses, three groups have been established: A, B and C, that will be explained in the next section.

The results for the criteria of each dimension of groups A, B and C can be seen in figures 3, 4 and 5 respectively. In all the figures the criteria of each dimension are ordered by the percentage of "Very Important" responses as previously the dimensions were ordered: at the top the criterion with the lowest value and at the bottom the one with the highest value.

VI. DISCUSSION
A. IMPORTANCE OF THE DIMENSIONS
As previously mentioned, 3 groups (A, B and C) were established based on the percentage of "Very Important" responses received. Group A is composed by those dimensions that obtain more than 40% (specifically, between 53.3% and 43.9%) of "Very Important" responses, group B are those that receive 40% but more than 20% (between 35% and 27.1%), and group C are those that receive less than 20% (between 17.8% and 13.1%).

The reason for choosing these three groups with these ranges is that the percentage of "Very important" responses of each dimension within a group is very close to each other and is far from the values of the other groups. The difference of each dimension with its immediate superior within group C is at most 2.8%, 2.3% in group B and 2.4% in group A, except for the difference of the Students with Teachers dimension,
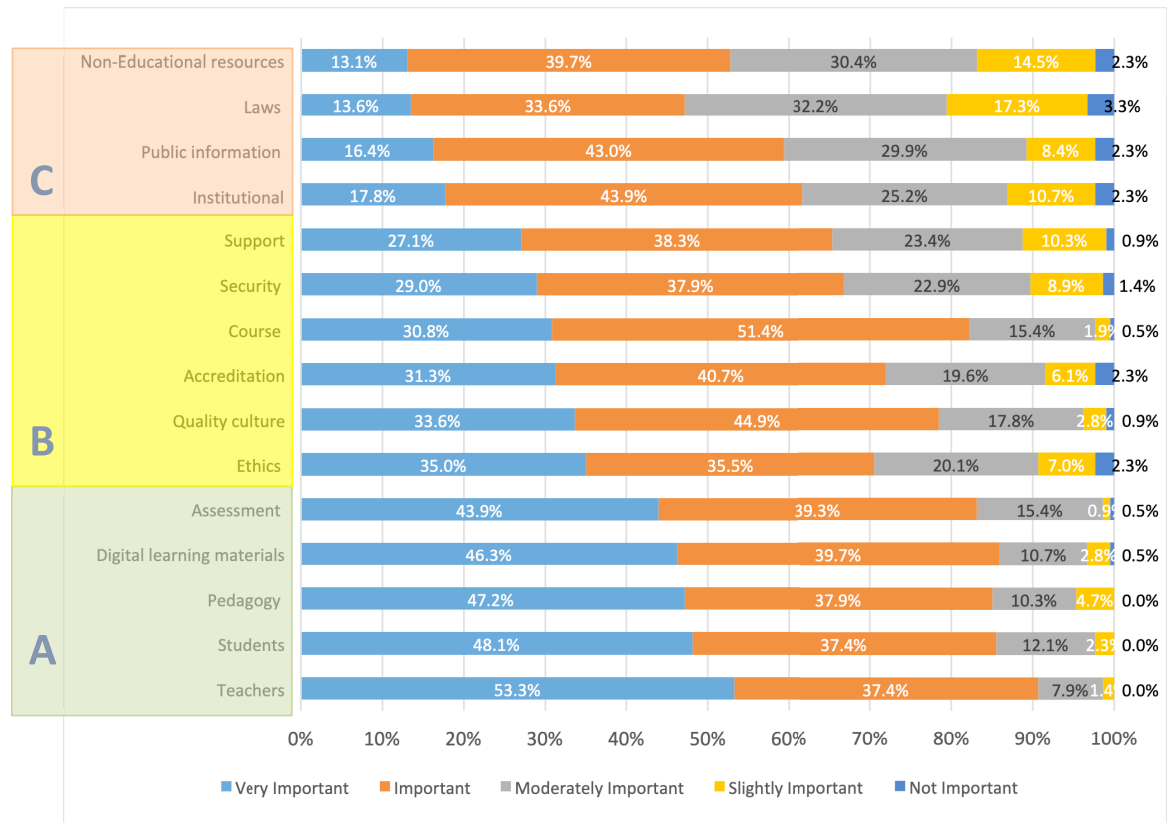
FIGURE 2. Importance of each dimension.

TABLE 9. Distribution of dimensions of group A by agency.

Dimensions	AFRICA	AMERICA				ASIA				EUROPE				OCEANIA	
	NAEDOSA	IHEP	C-RAC	**MEC/ SEC**	AFT	JUAA	**DEC**	MQA	CHED	QAA	NADE	OAQ	ODLQC	AQA	TEQSA
Assessment	√	√	√	√	√	√	√	√	√	√	√		√	√	√
Digital learning materials	√			√	√		√		√						√
Pedagogy	√		√	√	√		√	√				√	√	√	√
Students	√	√	√	√		√	√	√	√	√			√	√	√
Teachers	√		√	√	√	√	√	√	√			√		√	

which is 5.2%. And these values are lower than the difference between the edge dimensions of the groups, that is, the difference between the highest value of the dimension of group C and the lowest one of group B is 9.3% and the highest value of group B with respect to the lowest one in group A is 8.9%.

For the sake of simplicity and clarity, we will name VIP to the percentage of ''Very Important'' responses, and I+VIP to the percentage of the sum of ''Important'' and ''Very Important'' responses.

Therefore, the order of importance of a dimension or a criterion is A as the most important, then B as the next important and finally C as the least important, that is, in descending order.

As it can be seen in figure 2, the most important dimensions (group A) are, by order of decreasing importance, the following (the VIP and the I+VIP are put in brackets): Teachers (53.3%; 90.7%), Students (48.1%; 85.5%), Pedagogy (47.2%; 85.0%), Digital Learning Materials (46.3%; 86.0%) and Assessment (43.9%; 83.2%). All these dimensions are considered as least important by more than the 80% of the respondents, and in the case of ''Teachers'', by more than 90%.

In group B, the dimensions are considered ''Very Important'' in more than 20% and less than 40% of the respondents. These are, in order of importance, the following (the VIP is in brackets): Ethics (35%), Quality culture (33.6%), Accreditation (31.3%), Course (30.8%), Security (29.0%)
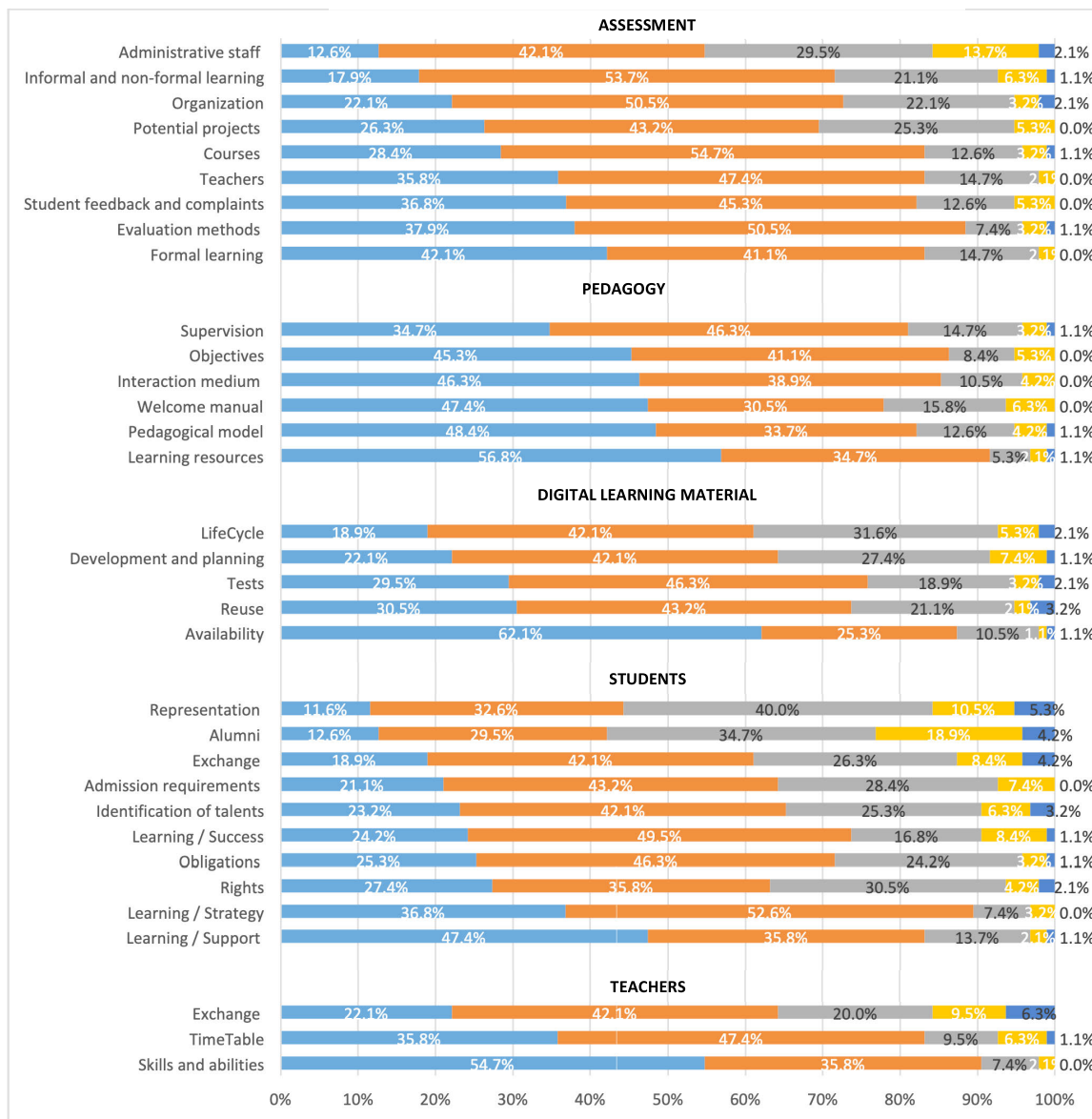
FIGURE 3. Importance of each criterion in the dimensions of group A.

and Support (27.1%). Regarding the I+VIP, all these are greater than 60%, some of them are greater then 70%, as Accreditation, Ethics, Quality Culture and Course, and this last one is greater than 80%, like those of group A. If the dimensions Course (group B) and Assessment (group A) are compared, that is, the dimensions in the border between group B and group A, the Course has an I+VIP of 82.2% and the Assessment of 83.2% (one point difference), but the Course has a VIP of 30.8% and the Assessment of 43.9% (13.1 points difference).

In group C the dimensions have a VIP less than 20%. These are the following: Institutional (17.8 %), Public information (16.4%), Non-Educational resources (13.1%) and Laws (13.6%). All of them have a VIP greater than 10% and an I+VIP greater than 50%, except Laws, that is only greater than 40%. The difference between the dimension of group

C with greater I+VIP (Institutional, 61.7%) and the dimension of group B with the lowest I+VIP (Support, 65.4%) is 3.4 points. However, their corresponding VIP are 17.8% and 27.1%, a difference of 9.3 points. These are the dimensions in the border between the groups C and B.

Only three agencies of the fifteen in this study have considered the five dimensions of the group A. As it can be seen in table 9, these agencies are NAEDOSA, MEC/SEC and DEC. The agencies C-RAC, AFT, MQA, AQA and TEQSA fulfill 4 out of these 5 dimensions; IHEP, AFT, CHED, OAQ and ODLQC fulfill 3, CHED fulfills 2 and NADE only 1.

B. IMPORTANCE OF THE CRITERIA

The distribution of the different criteria of the dimensions of group A is shown in figure 3. Applying the same structure according to the responses VIP and I+VIP as with the
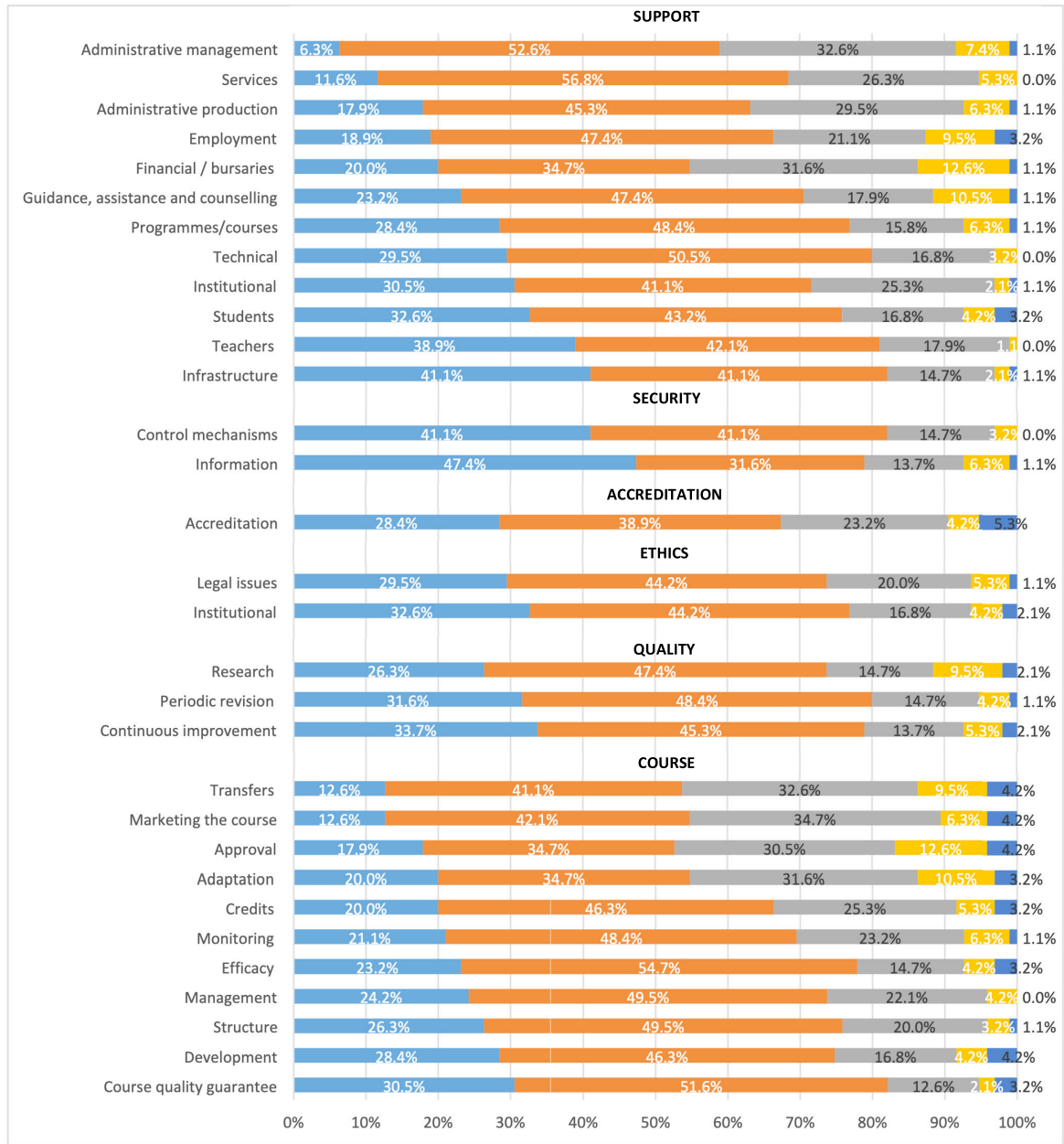
FIGURE 4. Importance of each criterion in the dimensions of group B.

dimensions (in the previous subsection), there are three sub-groups: A.A when responses VIP are at least 40%, subgroup A.B when these responses are between 20% and 40%, and subgroup A.C when they are less than 20%. Only it should be highlighted that in the part of criteria there were 95 respondents, compared with 214 in the dimensions' part.

It should be noted that there are 9 criteria in subgroup A.A, 18 in subgroup A.B and 6 in subgroup A.C. It is noteworthy that every dimension has at least one criterion of subgroup A.A, with the dimension of Pedagogy having the higher number of criteria in subgroup A.A, specifically 5 out of the 6 criteria, being the other (Supervision) in subgroup A.B,

but with a VIP near 40%. From the six dimensions of this group A, two of them, Teachers and Pedagogy, have all their criteria in subgroup A.A or A.B.

The distribution of the different criteria of the dimensions of group B is shown in figure 4. Following the same structure, it can be seen that there are 3 criteria in subgroup B.A, 21 in B.B and 7 in B.C. Only two dimensions, Security and Support, have criteria in subgroup B.A. The case of the dimension Security is special, because its two criteria are in group B.A, although the dimension Security is not in group A. This is due to the fact that only 95 persons responded to the criteria part compared with 214 who responded to the dimensions' part.
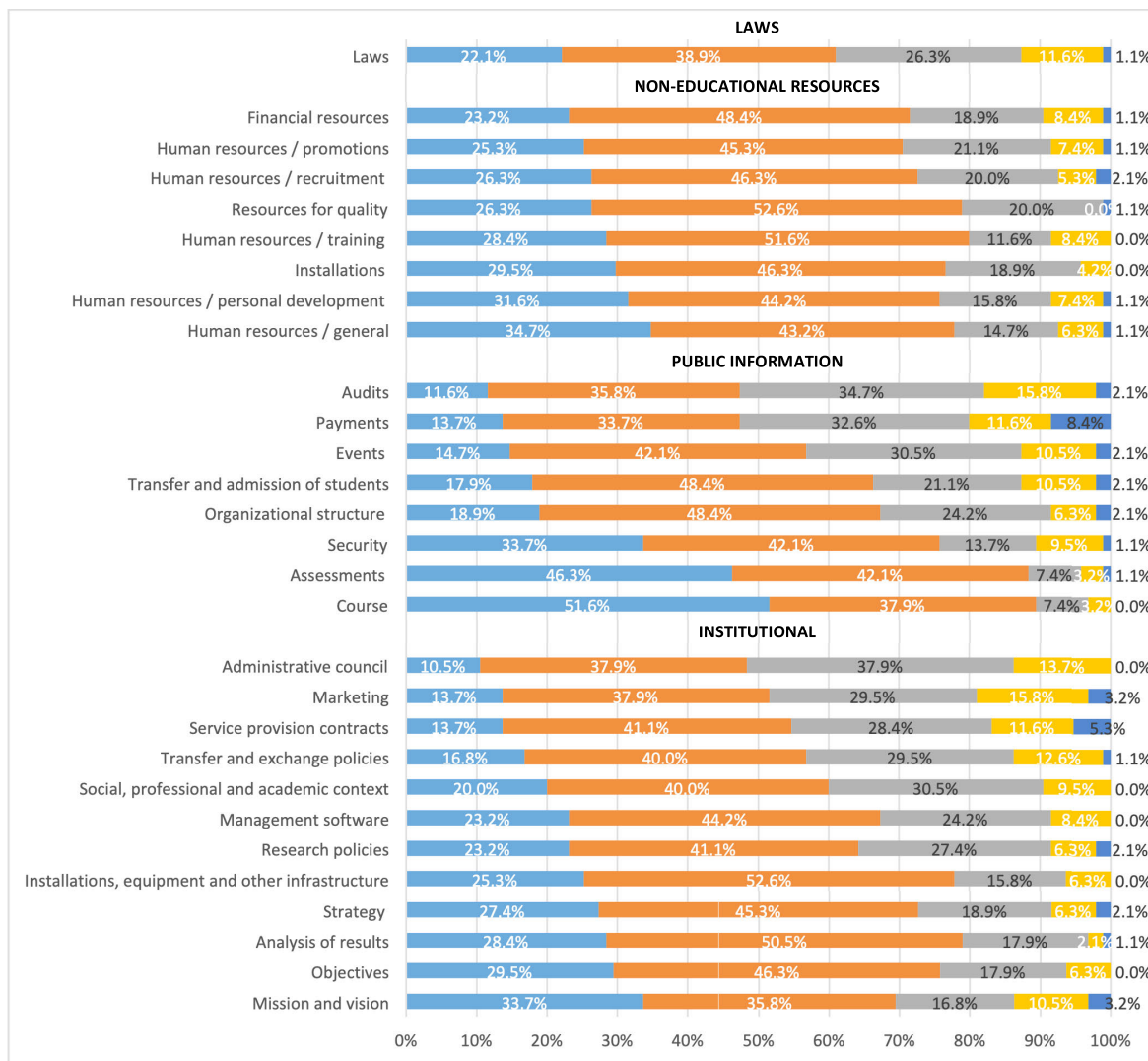
FIGURE 5. Importance of each criterion in the dimensions of group C.

The distribution of the different criteria of the dimensions of group C is shown in figure 5. Following the same structure, it can be seen that there are 2 criteria in subgroup C.A, both in the dimension of Public Information, 18 criteria en C.B and 9 in C.C. All the dimensions have at least one criterion in group C.B, only one dimension (the afore mentioned Public Information) has criteria in C.A, and two dimensions have criteria in subgroup C.C, that are Institutional and Public Information.

All the criteria of dimensions are shown in figure 6 in order to have a global vision of the importance of the criteria and dimensions. All the names of the dimensions are preceded by its order of importance (in brackets) according to the figure 2. All the criteria within a dimension are placed in the table in decreasing order of importance: if criterion x is above criterion y is that this criterion x is more important than criterion y. The criteria classified as group A are in green, those of group B are in yellow, and finally those in

group C are in orange. The bolded criteria are those that are in the border between two groups. So, the following criteria are between group B and C: Lifecycle, Employment and Organizational Structure, all of them with 18.95% of VIP; Adaptation, Credits, Financial/bursaries (scholarships) and Social, professional and academic context, with VIP of 20%; and Monitoring, with VIP of 21.05%. And the following criteria are between A and B: Control mechanisms, Infrastructure, both with a VIP of 41.05%, and Teachers with a VIP of 38.95%. The red-bolded criterion Administrative management is the only one (including the dimensions) that has a VIP less than 10%, specifically 6.32%.

Note that the difference of the criteria at the edge of the groups is not as clear as the difference of the dimensions, ant that is the reason for highlighting these criteria at the edge of groups.

If the criteria and not only the dimensions are considered, none of the aforementioned agencies (NAEDOSA,

FIGURE 6. Classification of the criteria of the dimensions (Green: group A, Yellow: group B, Orange: Group C).

TABLE 10. Criteria of group A satisifed by the Agencies fulfilling dimensions of group A.

Dimensions	Criteria	NAEDOSA	MEC/SEC	DEC
Assessment	Students´ formal learning	√	√	√
Digital learning materials	Availability	√		√
Pedagogy	Interaction Medium		√	√
	Learning Resources	√	√	
	Objectives			
	Pedagogical Model	√	√	√
	Welcome Manual		√	
Students	Learning/Support			
Teachers	Skills and abilities		√	√

TABLE 11. Classification.

criteria / dimensions	A (green)	A and B (green + yellow)	A and B and C (green + yellow+ orange)
A	A	A$^+$	A^{++}
B	B	B$^+$	B^{++}
C	C	C$^+$	C^{++}

C. A PROPOSAL OF CLASSIFICATION

Taking into account all the above conditions, the classification of an institution could be as follows (table 11):

Classify each institution with the corresponding letter A, B or C, or any combination of these three letters, if it meets the main criteria (subgroup A) of the dimensions of group A, B or C, respectively. The order will always be A, B, C, because this is the order of the dimensions from highest to lowest VIP. If, in addition, the institution meets any more subgroup (B or C) of criteria of each group of dimensions (A, B or C), a superscript "+" will be added to each letter.
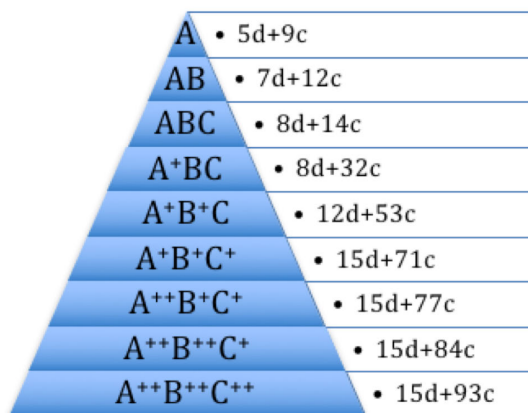
MEC/SEC and DEC) fulfilling the main dimensions (group A) fulfills all the main criteria (subgroup A.A), as it can be seen in table 10.

FIGURE 7. Pyramid of levels.

Thus, A means that the criteria A of dimensions A are met, A^+ indicates that the criteria of subgroups A and B of the dimensions of group A are met, and A^{++} would indicate that they meet all criteria of dimension A.

Thus, we could have an ABC classification, indicating that the institution meets criteria A of dimensions A, B and C; and if we have a classification A^+BC, it would indicate that it meets the criteria A and B of dimensions A and the A of dimensions B and C. However, a classification A^+B wouldn't have sense, because it breaks the order of importance of the classification, that is, this classification means that the criteria A and B of dimensions A together the criteria A of dimensions B, but not the criteria A of dimensions C that are more important than criteria B of dimensions A.

The structure of classification of the model is seen through the pyramid of levels (figure 7), where the different classifications in decreasing order from the top (most important: A) to the bottom (less important: $A^{++}B^{++}C^{++}$) of that pyramid are showed. At the right of every level it is the number of dimensions and criteria of the corresponding level.

Therefore, the classification A is considered the most important, since it contains the most important dimensions and within them the most important criteria (according to the results of the survey). This is composed of 5 dimensions and 9 criteria. These are in order of importance (in plain text the dimensions and in brackets the corresponding criteria): Teachers (Skills and abilities), Students (Learning/support), Pedagogy (Learning resources, Pedagogical model, Welcome manual, Interaction medium, and Objectives), Digital Learning Materials (Availability), and Assessment (Students' Formal Learning)

The other classifications are constructed from it. For example, the ABC classification is built by adding to the A classification the most important criteria (subgroup A) of the dimensions of groups B and C. It has 8 dimensions and 14 criteria in total, 3 dimensions and 6 criteria more than A classification: Security (Information and Control Mechanisms), Support (Infrastructure) and Public Information (Course and Assessment).

And so on, the rest of classifications could be constructed until the complete $A^{++}B^{++}C^{++}$, composed of the 15 dimensions and 93 criteria.

Finally, don't forget that there is no agency classified as ABC, not even as A (see table 10).

VII. CONCLUSION

Process-oriented quality aims to help organizations implement a quality system structured and focused on what is critical, i.e., creation, development and delivery, through a simplified, organized and team workflow [13].

In this sense, a set of fifteen standards and good practices, distributed by the five continents, were examined. A total of 112 dimensions and 409 criteria were initially identified, and after studying them, they were refined to a first model of 15 dimensions and 93 criteria.

With the exception of NAEDOSA, no agency has the 15 dimensions in its standards or good practices. Although NAEDOSA contains these dimensions, it does not have all the criteria, that is, it contains 50 out of the 93 criteria.

The next step was to validate this first model and to know, according to the opinion of a set of experts, which dimensions and criteria are considered more important.

According to the respondents' responses, three large groups for dimensions (in descending order of importance: groups A, B and C) were created.

Group A is composed by those dimensions that obtain more than 40% (specifically, between 53.3% and 43.9%) of VIP (Very Important Percentage) responses, group B are those that receive 40% but more than 20% (between 35% and 27.1%), and group C are those that receive less than 20% (between 17.8% and 13.1%). And the same structure can be applied for the different criteria within each group of dimensions. So, a classification based on these groups (A, B and C) of dimensions and criteria (figure 7) has been proposed (table 11).

The core model (those criteria of group A within the dimensions of group A) consists of the most important dimensions and criteria, 5 and 9 respectively, which are (in plain text the dimensions and in brackets the corresponding criteria): Teachers (Skills and abilities), Students (Learning/support), Pedagogy (Learning resources, Pedagogical model, Welcome manual, Interaction medium, and Objectives), Digital Learning Materials (Availability), and Assessment (Students' Formal Learning).

Therefore, several levels of compliance with the general model have been proposed and described through a pyramid of levels (figure 6). From the core model (5 dimensions and 9 criteria), the rest of levels can be constructed, adding the corresponding groups (A, B or C) of dimensions and criteria. Thus, for example the level ABC consists of 8 dimensions and 14 criteria, the $A^+B^+C^+$ level consists of 15 dimensions (all the dimensions) and 71 criteria (the groups A and B of dimensions A, B and C), until the whole level ($A^{++}B^{++}C^{++}$) consisting of the 15 dimensions and 93 criteria.

This work is a complete study of the various standards, specifications and good practices from the point of view of the process-oriented quality, and contributes to have a global vision of this topic. As far as we know, it is a unique global work on process-oriented quality in e-learning, and it may be considered as a first step in order to have a global standard on this topic. The next steps should be done by an agency of standardization, such as for example the IEEE.

But this work has also limitations. The most important is the number of experts who fulfill the questionnaire in order to validate the initial model. Obviously, it should be greater, but it is difficult to achieve this great number of respondents without the participation of an agency of standardization.

Taking into account this limitation, those criteria that are close to the border of groups have been identified. The opinion of more experts could change the groups of these criteria.

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