

Quality Standards in Online Education

The ISO/IEC 40180 Framework

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Abstract—As higher education institutions (HEIs) make growing use of online education, enhancing and ensuring quality in online education (QOE) have become increasingly important for their competitiveness. Researchers and both national and international organizations have developed a variety of models, frameworks and guidelines for QOE. However, selecting from these a holistic quality framework that meets the needs and requirements of HEIs is challenging. This study reviews current QOE frameworks, guidelines and benchmarks used in diverse contexts, with reference to an analysis of 72 publications between 2000 and 2019, then introduces the ISO/IEC 40180 framework for quality assurance, quality management and quality improvement in IT-enhanced learning, education and training. The findings show that while no holistic quality framework for open education exists currently, ISO/IEC 40180 is a flexible and adaptable framework for revolutionary organizational change, meeting the needs of multiple stakeholders of educational organizations at the macro, meso and micro levels. Therefore, HEIs seeking to foster growth, competitiveness and international recognition are advised to consider adopting the ISO/IEC 40180 framework, which should be integrated into national quality education standards.

Keywords—Online education, Quality standards, Quality framework, ISO/IEC 40180, Higher education.

1 Introduction

The widespread adoption of online education makes it increasingly important for higher education institutions (HEIs) to enhance and ensure quality in online education (QOE) to maintain a competitive advantage. Delimiting QOE is fundamental to the systematic monitoring of quality improvement and effective higher education reform [1]. A European survey by Ehlers et al.[2], to analyze quality in e-learning in general and participants' experience of using quality instruments in e-learning, found that quality plays a key role in the success of e-learning, that educational organizations should treat quality development as a core process and that open quality standards should be implemented widely. To this end, HEIs must implement certain quality standards to ensure sustainable quality in education [3]. Researchers and organiza-

tions, national and international, have developed various models, frameworks, benchmarks and guidelines to enhance and assure QOE [4]. The multiplicity of these approaches to QOE and their different scopes and objectives can cause confusion [5], so a key challenge to attaining quality in practice is selecting the most appropriate one to meet each HEI's requirements [6]. According to Stracke [7], there presently exists no holistic quality framework for open education adopting a total quality management philosophy and addressing all educational levels (micro, meso and macro). Thus, there is a need to derive a comprehensive QOE framework by reviewing existing models and frameworks with a view to adapting international standards to the local needs of HEIs [5,7,8].

Pawlowski [6] and Stracke [7] adapted and successfully implemented ISO/IEC 19796-1 and ISO/IEC 40180 respectively, concluding that it was important to take advantage of ISO opportunities. The purpose of the present research was to review several QOE frameworks, guidelines and benchmarks currently used in HEIs, then to determine the value of ISO/IEC 40180 (formerly ISO/IEC 19796-1) for quality assurance, quality management and quality improvement in IT-enhanced learning, education and training, comparing it with other frameworks.

2 Literature Review

Defining quality in online education is increasingly challenging. There is broad consensus in the literature that QOE is a complex and difficult concept which depends on a number of factors related to students, the curriculum, educational design and the technological means used, and to other organizational, planning and contextual factors [1, 4, 5, 6, 7, 9]. There is no common understanding of the terminology or methodology of quality, because it can be seen from a variety of perspectives and dimensions [6, 7, 9]. QOE has various meanings for multiple stakeholders (learners, academics, leaders, employers, and society) [9]. The variety of methods used to measure it includes commercial instruments, government and national standards and individual frameworks, which all identify different quality criteria. Among the QOE indicators considered are quality benchmarks, accreditation, measurement and standardization, all of which can be evaluated at three levels- micro (learning experiences at learner level); meso (individual courses at national level) and macro (online programs at institutional or national or international level) [6, 7, 9]. Since QOE and quality standards for conventional education are not identical, it is imperative to integrate e-Learning criteria into national quality assurance systems [10], which entail harmonizing stakeholders' differing views of quality.

Researchers have proposed a variety of models, frameworks and guidelines for QOE, including Khan's E-Learning framework, Frydenberg's e-Learning quality standards and the e-Quality framework of Masoumi and Lindström, while those developed by organizations investigating the overall quality of online and e-learning in diverse contexts include the Swedish E-Learning Quality model, the University of Pennsylvania quality course design standards, the British Open University e-Learning approach, the Norwegian Association for Distance Education model, the New Zealand

e-learning Maturity Model (eMM), the E-xcellence quality benchmarking instrument, the Online Learning Consortium (OLC) quality scorecard and the Hamdan Bin Mohammad Smart University model. A summary of some of the frameworks is presented in Table 2 and Table 3.

Ossiannilsson et al. [11] offer detailed descriptions of several quality models for online and open education, arguing that they all suffer deficiencies such as restricted applicability, failure to clarify which maturity levels they are best for, widely divergent quality of reviews and of information provided, and poor response to change. Having reviewed several QOE models, Esfijani [9] asserts that they remain fragmented and lack coherence, focusing mainly on resources, input and processes, and reports that there is no evidence for an output / outcome-oriented approach to identifying and measuring quality factors. He also notes that the same quality framework or benchmark has often been used in different educational cultures without any modifications, concluding that there needs to be a holistic approach which considers diverse aspects of quality factors including inputs, resources, processes, outputs and outcomes. In the same vein, Stracke [7] states that there is currently no holistic quality framework for open education that follows the total quality management philosophy, with continuous improvement cycles, applied at the micro, meso and macro levels. Furthermore, Farid et al. [12] observe that existing QOL models have been designed in developed countries, where online education does not face the same problems as in developing countries. Accordingly, applying these models to other cultural contexts is questionable [4].

In a globalized world, Ossiannilsson [5] emphasizes that any quality model for online education needs to be flexible enough to embrace and empower the rapid changes that institutions undergo, responsive to local context and globally recognized. She recommends adopting international standards and incorporating their principles to replace a mechanistic, tick-box understanding of quality assurance with a greater emphasis on learning, engagement, analysis and outcomes. Similarly, Esfijani [9] suggests that HEIs should ensure QOE by adopting a universal quality framework or international standards, while responding to advanced technologies and techniques within the requirements of their particular contexts. A holistic framework for QOE would be beneficial for all open education, but it should be customized to each institution's context specific. According to Ozbek [13], as exchange programs and collaboration among universities increases rapidly, mutual compatibility grows in importance, with many HEIs seeking internationally accepted quality standards in response. By adopting international standards such as ISO, higher education institutions can guarantee the professionalism of the diverse workforce in dealing with diverse learners and stakeholders [13]. Several studies reveal that adopting ISO series standards helps HEIs, especially in developing countries, to advance their standards for attaining the international recognition [14,15,16].

3 The International Organization for Standardization

The International Organization for Standardization (ISO) was established in 1946 in Geneva, Switzerland. ISO has developed over 23117 quality international standards for all types of organizations (iso.org). The ISO and the International Electrotechnical Commission (IEC) have worked intensively on e-learning standardization since 2004 [10]. The main standards in the ISO series for education are shown in the table 1 below.

Table 1. Descriptions of ISO series for education

ISO Series for education	Description
ISO/IEC 19796-1:2005 – Part 1	Information technology - Learning, education and training - Quality management, assurance and metrics - Part 1: General approach. This is "a framework to describe, compare, analyze and implement quality management and quality assurance approaches" [17]. Its principal feature is the Reference Framework for the Description of Quality Approaches (RFDQ).
ISO/IEC 19796-2:2009 – Part 2	Information technology - Learning, education and training - Quality management, assurance and metrics - Part 2: Harmonized Quality Model. This second part "consists of a complete quality management system for education and further education, with certification possibilities" [18].
ISO/IEC 19796-3:2009 – Part 3	Information technology - Learning, education and training - Quality management, assurance and metrics - Part 3: Reference methods and metrics. The RFDQ "provides a harmonized description of the methods and metrics required to implement quality management and quality assurance systems for stakeholders designing, developing, or utilizing information technology systems used for learning, education, and training" [18].
ISO/IEC 40180:2017	Information technology - Quality for learning, education and training - Fundamentals and reference framework. This "is a revision of ISO/IEC 19796, comprising the fundamentals and the reference framework for quality assurance, quality management and quality improvement in IT-enhanced learning, education and training, harmonizing existing approaches, concepts, specifications, terms and definitions related to quality for e-learning, education and training" [19].
ISO 29993:2017	Learning services outside formal education - Service requirements. This "specifies the requirements for informal learning services, including all types of life-long learning (e.g. vocational training and in-company training, either outsourced or in house) and the provisions of learning service providers addressed to learners themselves, as well as to sponsors acquiring the services on behalf of learners". The key features of such services are that the goals of learning are defined and the services are evaluated, and that they involve interaction with the learner. The learning can be face to face, mediated by technology, or a combination of both [20].
ISO 21001:2018	Educational organizations - Management systems for educational organizations - Requirements with guidance for use. This standard "specifies requirements for a management system for educational organizations that uses a curriculum to support the development of competence through teaching, learning or research, regardless of the type, size or method of delivery, such as professional training departments" [21].

Many universities worldwide use ISO series quality standards [13] and ISO/IEC 40180 is widely recognized as a framework for open education, because it can be adapted to the needs of HEIs anywhere [7]. However, there are limited studies providing empirical evidence for its benefits for online education. One recent study (Stracke[7] introduces the OpenEd Quality Framework, a modification for open edu-

cation of the Reference Process Model of ISO/IEC 40180 which integrates the three quality dimensions (Learning objectives, Learning realization and Learning achievements) and applies them at the macro, meso and micro levels. Stracke argues that this framework combines the different quality perspectives in a holistic approach by mapping them to the learning design, processes and results, and that it can be combined with certain other quality frameworks such as the Quality Reference Framework (QRF) and the IDEA(L) (Initiate, Do, Evaluate, Act) framework. The OpenEd Quality Framework can also be applied to MOOCs (massive open online courses) and (OER) open education resources.

In an earlier study, Pawlowski [6] adapted ISO/IEC 19796-1 to develop the quality adaptation model, identifying four main steps as necessary to implement it successfully in response to the needs of stakeholders at the macro, meso and micro levels: context setting, model adaptation, model implementation/adoption and quality development. Each step should be performed with a broad range of interested parties to raise awareness and reach consensus. Pawlowski recommends considering the cultural factors of the different countries when adapting the model.

According to Ozbek [13], ISO standards are global and scalable, with inherent flexibility that fosters creativity and efficiency for any HEI which adopts them. ISO series provide generic standards which support common understanding and consistent practices (Kezar & Eckel, 2002). To ensure that such generic standards can be applied in diverse contexts, whatever the modes of teaching and learning, their operational principles must be contextually sensitive [10].

4 Methodology

The main aims of this research are to review the QOE frameworks, guidelines and benchmarks currently used in HEIs, to examine the applicability of the ISO/IEC 40180 framework for quality assurance, quality management and quality improvement in IT-enhanced learning, education and training, and to compare it with other frameworks.

4.1 Research questions:

1. What standards of QOE are identified in the literature?
2. What are the characteristics of the ISO/IEC 40180 framework relevant to the quality standards of online education in the context of HEIs?

These questions were addressed by conducting an extensive literature review of 72 studies examining quality of online education in higher education published between 2000 and 2019 in indexed and peer-reviewed journals, government reports, web pages and books, to identify and review the available frameworks, models, guidelines, benchmarks, etc. related to QOE in online education in HEI. The following key words were used for this research: online learning quality, e-learning quality, online educa-

tion quality, e-learning quality standards, quality of virtual learning, quality of technology-enhanced education and e-learning course design standards.

The selected publications were coded according to:

1. Stakeholders’ perspectives (learners, academics, librarians, administrators, technicians, leaders, employers, administrators).
2. Level (macro, micro, meso).
3. Quality terms (standards, benchmark, framework, criteria).
4. Source (researchers, organizations).

5 Findings and Discussion

The reviewed literature reveals that many quality standard models have been developed for specific purposes, in different contexts. Table 1 gives examples of the well-know QOE standards based on the literature, while Table 2 shows several studies that contributed to QOE standards from different perspectives and for different online education levels.

Table 2. Descriptions of several well-known QOE frameworks

Quality model	Description
eMM	The New Zealand e-learning Maturity Model is a quality improvement framework. It provides a set of 35 processes, divided into five process areas: learning, development, support, evaluation and organization. The eMM consists of five dimensions: delivery, planning, definition, management and optimization. Each dimension is broken down further into practices. The dimensions describe the capability of practices from a lower (delivery) dimension to higher (optimization) dimension. An institution having capability in all dimensions for all processes is considered to be very capable of providing e-learning practices. An institution that has developed capability in higher dimensions but lacks it in the lower dimensions will not deliver the desired outcomes[22]. According to Marshall[22], the main weaknesses of the eMM include the lack of systems analyzing the impact of technology on student learning and staff teaching activities. Another common weakness is that the e-learning process resources are designed and managed to maximize reuse, whereas most universities were found to have minimal commitment to reuse. Other limitations were the lack of pedagogical support for students and the lack of information to help them prepare for the use of technology in their studies.
ACODE	The Australian Council on Open, Distance and e-learning developed ‘benchmarks for Technology Enhanced Learning’, to be used for self-assessment, or as part of a broader benchmarking activity between HEIs. The framework, comprising eight benchmarks which can be used as standalone indicators or as an integrated whole to reflect the institutional perspective, covers the following topics: <ul style="list-style-type: none"> • Institution-wide policy and governance for technology enhanced learning; • Planning for institution-wide quality improvement of technology-enhanced learning; • Information technology systems, services and support for technology-enhanced learning; • The application of technology-enhanced learning services; • Staff professional development for the effective use of technology-enhanced learning; • Staff support for the use of technology-enhanced learning; • Student training for the effective use of technology-enhanced learning; • Student support for the use of technology-enhanced learning. Each of the 8 benchmarks includes a Scoping Statement, a Good Practice Statement, a set of Performance Indicators, based on a 5-point scale, and a space for initial recommendations on issues that emerged from the assessment and which may need improvement.
E-excellence	The E-excellence quality benchmarking instrument was developed by the European Association of Distance Teaching Universities to support HEIs enhancing their online, open and flexible education at program, faculty and institutional levels. It offers a supplement on e-learning issues specific to existing local quality systems, without interfering with ordinary quality assurance systems in higher education [23]. E-excellence focuses on improving four elements of progressive higher education: accessibility, feasibility, interactivity and personalization. 33 benchmarks are grouped into three areas covering six fields: strategic management, products (curriculum design, course design, course delivery) and services (staff and student support) [11, 2015]. Benchmarking can be accomplished either online, via a guided self-assessment called QuickScan, or with a full evidence-based assessment, or both. The simplified QuickScan is supplemented by a full online manual, available on a web portal (http://e-excellencelab1.ceddlu.eu/tool/quickscan), resulting in insight for improvement. E-excellence includes additional material reflecting on new and recent trends, such as MOOCs, learning analytics, virtual and remote laboratories, digital badges and e-portfolios [24]. The framework was empirically validated using a mixed-method approach in 5 universities. Although findings indicate that it requires fine-tuning and that its application should be contextualized, it was concluded that benchmarking is a powerful tool to support improved governance and management in higher education, in alignment with national and international quality agendas.
OLEC	The OLEC quality scorecard for blended learning programs is developed by the Online Learning Consortium (OLC)[25]. It is accompanied by a handbook which also serves as a catalogue of best practices (The tool has eight categories, monitored by a total of 70 indicators: Institutional support (9 indicators), Technology support (7), Course development and instructional design (14), Course structure (8), Teaching and learning (5), Faculty support (6), Student support (11), Evaluation and assessment (10). Each indicator is scored by the institution’s administrator on a scale from 0=deficient to 3=exemplary, giving a maximum possible total score of 210 points, which can be interpreted as follows: <ul style="list-style-type: none"> • Exemplary: 90-100% (189-210 points) • Acceptable: 80-90% (168-210 points) • Marginal: 70-79% (147-167 points) • Inadequate: 60-69% (126-146 points) • Unacceptable: <59% (<125 points) Overall, the OLEC tool is well documented and comprises a comprehensible set of indicators. It offers recommendations for each indicator, giving administrators advice on improving the score, but the points are not related to a particular stage or level of blended learning.
DLEG	The Distance Learning Evaluation Guide was developed by the American Council on Education and the Distance Education and Training Council. It is designed as a checklist and organized logically for direct use to measure the quality of online courses. The DLEG covers 12 aspects: <ol style="list-style-type: none"> 1. Institutional mission, goals and objectives, 2. Educational program objectives, curricula and materials, 3. Educational services, 4. Student services, 5. Student achievement and satisfaction, 6. Qualification of institution, officers, governing board members, administrators, instructors/faculty and staff, 7. Admission practices and enrollment agreements, 8. Advertising, promotional literature and recruitment, 9. Financial responsibility, 10. Tuition policies, collection procedures and refunds, 11. Plant equipment and record protection, 12. Research and self-improvement. If this address most of the quality elements of distance education. However, to ensure a high-quality education for all, the standards should be modified to meet the needs of all students and used to understand and make informed decisions about blended and online learning programs.
QM	The Quality Matters Rubric [26] is a set of eight standards, with 41 specific indicators that can be used to evaluate the quality of design of online and blended learning courses. It focuses on the alignment of learning objectives, assessment and measurement, instructional materials, learner interaction and engagement, and course technology, in order to ensure students achieve the specified learning outcomes. The eight General Standards of the Rubric are: <ul style="list-style-type: none"> • Course Overview and Introduction • Learning Objectives (Competencies) • Assessment and Measurement • Instructional Materials • Learning Activities and Learner Interaction • Course Technology • Learner Support • Accessibility and Usability Meeting the quality standards at or above the 85% level qualifies a course to receive a QM Certification for quality course design. The main concern is to prepare faculty to participate in the peer-review process and apply the rubric (Egon & Runyon, 2007). Without proper training, the rubric can be used in ways for which it was not intended, resulting in confused data and inaccurate claims of meeting QM standards, thereby negatively impacting students.

Table 3. Key articles on QOE standards - Modified from Esfijani [9]

Author	Stakeholders	Standards	Level
(Khan [27])	Educators	Pedagogical dimension Technological dimension Interface design dimension Evaluation dimension Management dimension Resource support dimension Ethical dimension Institutional dimension	Macro
(Frydenber [28])	Educators	Executive commitment. Technological infrastructure. Student services. Design and development. Instruction and instructor services. Program delivery. Financial health. Legal and regulatory requirements. Program Evaluation	Macro
(McGorry [29])	Students	Flexibility Responsiveness Interaction Student learning Technical support Technology Student satisfaction	Micro
(Walker & Fraser, [30])	Students	Instructor support Student interaction and collaboration Personal relevance Authentic learning Active learning Student autonomy	Micro
(Young & Norgard, [31])	Students	Course design Course interactions Course content Course support Course delivery	Meso
(Shelton [32])	Admins	Institutional support Technology support Course development & design Course structure Teaching and learning Social and student & engagement Faculty support Student support Evaluation and assessment	Meso
(Gordin & Hall [33])	Faculties	Learner support Online organization and design Instructional design and delivery Assessment and evaluation Innovative teaching with technology Use of student feedback	Meso
(Agariya & Singh [34])	Students Faculties	Course content Design structure Collaboration Industry acceptance	Meso

Author	Stakeholders	Standards	Level
		Value addition Transparency in assessment Technical know-how Engagement	
(Masoumi & Lindstrom [4])	Students Faculties Admin	Institutional factor Technological factor Instructional design factor Pedagogical factor Faculty support Student support Evaluation factor	Meso
(Ashlaghi et al., 2013)	Students Faculties Admin	Institutional support Teaching & learning Course development Course structure Faculty support Student support Evaluation	Meso
The University of Pennsylvania e-learning model		Navigation, Student Orientation, Curriculum, Communication and Availability, Course Resources Requirements, Technical Support, Accessibility Requirements, Learning Objectives, Learning and Assessment Activities, Copyright Requirements, Functionality and Reports for course improvement.	Meso
The Swedish e-Learning Quality (eLQ) model. (eLQ [35])	Students Educators	Material/content, Structure/virtual environment, Communication, Cooperation and interactivity, Student assessment, flexibility and adaptability, Support (student and staff), staff qualifications and experience, Vision and institutional leadership, Resource allocation.	Meso
Hamdan Bin Mohammad Smart University (MeLQ) model (OU-UK [36])		Strategic Dimension Learning and Teaching Dimension Organizational Dimension Change Dimension Economical Dimension Technological Dimension	Macro

The reviewed literature reveals that most of these standards address online course design and online program. Several studies conclude that it is essential to engage all actors involved in distance/online education: Developers, administrators, governments, providers, teachers and learners [7,12]. The review also reveals a general focus on input criteria, such as facilities and support for faculty or students, rather than on outputs and outcomes like student learning and employment, as shown in Table 1. This finding is consistent with those of Esfijani [8] and Ransom et al. [9]. The aspects

of a quality experience in the online learning environment most commonly addressed in the literature are:

1. Institutional support (vision, planning, and infrastructure)
2. Course design and development
3. Teaching and learning (instruction)
4. Student and faculty support
5. Technology support
6. Assessment
7. Security

However, there are significant differences in quality terminology and in the aggregation of the quality criteria according to these aspects, making it difficult to compare the various frameworks and models. This finding is similar to one reported by Butcher and Wilson-Strydom [37].

Analysis of the literature indicates that none of these quality standards is comprehensive, each having been developed for a specific purpose in a given context. Indeed, the quality criteria and standards reviewed were mostly developed in the West for use there. This result is consistent with the assertion of Stracke [7], Esfijani [9] and Faried et al. [12] that there is no holistic standard for open education that addresses all stakeholders' needs at all three levels. Masoumi and Lindstrom [4] justifiably conclude that these approaches can be applied only cautiously in other contexts. It is also noted that most of the quality criteria and standards are based on theoretical findings and have yet to be translated into practical principles or tested in different contexts. Other shortcomings are that most of the frameworks and models are fairly broad and lack details, and that neither validation nor guidelines are provided for their utilization.

The analysis reveals that none of these quality standards specifies how to respond to changes in stakeholders' interests or in HEIs' internal and external environments; nor do they take into account technological evolution or the different types of digital media and resources that could be integrated into learning, despite the need for quality standards to be continually adaptable and scalable to any such changes [5,13]. In particular, the globalization and international competitiveness of universities makes harmony with international standards a key requirement for any national quality standards in education. So, what is needed is the development of global standards and quality assurance frameworks that can improve pedagogy in diverse cultural, knowledge and delivery platforms in the parallel worlds of reality and virtual reality [38].

5.1 ISO/IEC 40180

ISO/IEC 40180 is an international standard which "provides the fundamentals and the reference framework for quality assurance, quality management and quality improvement in IT-enhanced learning, education and training (e-learning)". Its principal element is the quality reference model (QRF), "a common and generic framework to describe, specify and understand critical properties, characteristics and metrics of quality", consisting of three parts ISO [20]:

1. The Process Model is a guide to the relevant processes for developing learning scenarios within the whole life cycle of online education. Its seven process categories (Needs Analysis, Framework Analysis, Concept/Design, Development/Production, Implementation, Learning Process/Realization and Evaluation/Optimization) and 38 sub-processes are shown in Figure 1.
2. The Description Model is a scheme to describe and document quality approaches in a transparency way such as guidelines, design guides and requirements. It provides processes to develop online education scenarios by specifying quality objectives, methods to ensure quality, the actors involved, and relations with other processes, evaluation methods, standards and references. Table 4 outlines an example.
3. A comprehensive list of context-specific Reference Quality Criteria (RQC) is provided for the evaluation of the quality of learning products based on the Process Model. The list includes media- and learning psychology-related criteria, as well as those related to data security and to national legislation.

NA: Needs Analysis	FA: Framework Analysis	CD: Conception / Design	DP: Development Production	IM: Implementation	LP: Learning Process/ realization	EO: Evaluation/ Optimization
NA1:Initiation	FA1:Analysis of the external context	CD1:Learning objectives	DP:1Content realization	IM1:Testing of learning resources	LP1:Administration	EO1:Planning
NA2:Stakeholder identification	FA2:Analysis of staff resources	CD2:Concept for contents	DP2:Design realization	IM2:Adaptation of learning resource	LP2:Activities	EO2:Realization
NA3:Definition of objectives	FA3:Analysis of target groups	CD3:Didactical concept methods	DP3:Media realization	IM3:Activation of learning resources	LP3:Review of competency levels	EO3:Analysis
NA4:Demand analysis	FA4:Analysis of the institutional and organizational context	CD4:Roles and activities	DP4:Technical realization	IM4:Organization of use		EO4:Optimization / Improvement
	FA5:Time and budget planning	CD5:Organizational concept	DP5:Maintenance	IM5:Technical infrastructure		
	FA6:Environment analysis	CD6:Technical concept				
		CD7:Media and interaction design				
		CD8:Media concept				
		CD9:Communication concept				
		CD10:Concept for tests and evaluation				
		CD11:Concept for maintenance				

Fig. 1. Example of QRF Process Model description from ISO [20]

Table 4. Overview of the Process Model

ID	Category	Process	Description	Relation
CD.7	Conception/Design	Concept of media and interaction design	Definition of media and interaction design	NA.3; NA.4; CD.1; CD.2; CD.4; CD.6
Sub-processes/Sub-aspects		Media design Interaction design		
Objective		Representation of the design concept concerning all relevant fields in consideration of existing templates/guidelines		
Method		<i>Development of screen and human-computer interaction design based on specifications of software ergonomics, usability and corporate design</i>		
Result		Documentation of design principles (<i>design concept, style guide</i>) <i>Design prototype</i>		
Actor		<i>Design experts, Experts media didactics</i>		
Metrics/Criteria		<i>Usability test on the basis of the design prototype</i> <i>Heuristic evaluation</i> <i>Categories 2, 6, 8 of RQC</i>		
Standards		<i>ISO 9241, ISO 13407, W3C-Accessibility-Guidelines</i>		

The main characteristics of ISO/IEC 40180 are as follows:

Harmonization: The QRF for e-learning serves to compare diverse standards and to harmonize these towards a common quality model. The description model provides considerable information and guidance to develop a harmonized scheme to describe quality approaches. It provides sector-specific information useful in integrating mandatory and facultative quality approaches at the organizational, local, regional, national and international levels. Therefore, HEIs can implement ISO/IEC 40180 in harmony with their institutional vision, mission, values, goals and objectives.

Flexibility/adaptability: The process model provides a general framework that can be extended and adapted to the specific situation, organization, target group and requirements. The potential advantage for an HEI is that in practice, quality standard processes have to be selected and adapted to align with stakeholders' needs and with the organization's mission, vision, objectives and action plans. The flexibility of the QRF supports the development of quality profiles for organizations, meaning that the generic standard is tailored to the HEI's requirements [6]. Flexible and adaptable instruments are fundamental to QOE, to accommodate rapid changes in technology and both internal and external environments [7]. Thus, Stracke [7] proposes modifications to reflect the fact that two of the process categories in Figure 1 may be performed together, or that evaluation and optimization, for example, could be done separately. In addition, we want to highlight the importance of optimization and the involvement of learners in the crucial process of continuous quality development.

Contextualization: Importantly, the process model begins by analyzing the organization and its context, external and internal, as reflected in sub-processes FA1 and FA4 (Figure 1). The external analysis should consider legal, political and economic circumstances, social expectations, technological evolution, and international and local competition, while analysis of the institutional and organizational context focuses on strategic items such as vision and mission, resources, campus facilities and

stakeholders' interests. One size does not fit all in education and an HEI adopting ISO 40180 can respond promptly to its changing context.

Stakeholders: Achieving QOE means evolving to suit all stakeholders, whose requirements for quality standards differ greatly [12, 37]. By addressing harmonization throughout the development process, beginning with stakeholder identification as an element of needs analysis, ISO/IEC 40180 considers the roles, interests, expectations and requirements of all key partners interested in improving QOE at all levels: learners, academics, trainers, tutors, designers, administrators, enterprises, organizations, examination boards, regulators, universities, sponsors, cooperating institutions, clients, relevant social groups, national and international bodies. The HEIs must seek consensus about quality among its stakeholders; in practice, this entails meeting their diverse and changing needs and expectations, which the ISO/IEC 40180 enables holistically [7].

Process orientation: The QRF is not prescriptive or systematic, specifying a sequence of processes or an outcome, but general, descriptive and process-oriented, making no assumptions about required quality approaches. The process model is generic, covering all phases of online education and serving as a guideline to develop quality concepts from conception to evaluation and optimization, while the description model allows all kinds of processes to be modeled and documented in a transparency manner. The ISO/IEC 40180 provides set of best practice examples that help to understand and manage the interrelated processes of inputs and outputs and outcome that operate as a coherent system.

Evaluation and optimization: ISO/IEC 40180 provide a comprehensive list of reference criteria to be used in analyzing and evaluating online education for different purposes. Only criteria which are suitable for a certain context should be used. Use of the RQC makes the evaluation process more transparent and comparable, because they relate to a standardized set of criteria.

Compatibility: ISO/IEC 40180 is compatible with and complementary to ISO 9000, ISO 9001 and other series including ISO 14001 and ISO 21001. Further, the QRF can be used as a meta-model for online education incorporating other approaches such as Plan, Do, Check, Act. According to Pawlowski [6], a variety of existing approaches can be used for different objectives and purposes, and the QRF provides clear terminology and description formats to assemble specific quality concepts from these. The common terminology of ISO/IEC 40180 facilitates such recombination; for example, (AACSB) Association to Advance Collegiate School of Business or (ABET) Accreditation Board for Engineering Technology quality standards can be combined and integrated with international standards for application in specific cases. ISO/IEC 40180 ensures that the processes of university teaching and thus outcomes meet local and international standards.

6 Conclusion

Quality in online education is critical for HEIs' competitively. Despite the many frameworks, models and tools proposed for QOE, no holistic quality framework for

open education currently exists, but ISO/IEC 40180 is an international and scalable standard adaptable to this context, since characteristics including harmonization, flexibility, contextualization, process orientation and compatibility make it a holistic framework for use which meet all stakeholders at all educational levels. Implementation of standards is particularly difficult in HEI settings and success depends on analyzing context and adaptation; therefore, a practical guide is needed.

With the emergence of assistive technologies such as artificial intelligence and machine learning, the process of analyzing the context of any HEIs at the macro, intermediate and micro levels is more efficient and consistent. The adoption of ISO/IEC 40180 will help a university to be internationally recognized. The responsiveness of ISO standards to rapid changes ensures future improvements.

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