A QUALITY ASSURANCE FRAMEWORK FOR OERs BASED ON QUALITY SEALS AND THE PHOTODENTRO SEALS REPOSITORY

Elina Megalou, Kostis Alexandris, Eugenia Oikonomidou, & Christos Kaklamanis
Computer Technology Institute & Press "DIOPHANTUS" (Greece)

Abstract

Open Educational Resources (OERs) offer unique opportunities to enhance the quality of education and ensure equitable access to learning resources. A major concern, however, is the quality of OERs. This article presents a *generic conceptual framework* for the *Quality Assurance (QA)* of OERs based on *Quality Seals* and introduces the *Photodentro Quality Seals (QS) Repository and e-service* (photodentro.edu.gr/seals), which was initiated and developed to support the quality assurance processes of the Greek national digital OER repositories for primary and secondary education. The proposed QA framework is based on three main entities: *Quality Seals* (describing either a set of quality criteria, a well-defined quality assurance procedure, or a reliable source of origin); *Quality Seal holders* (e.g., OER certifiers)*; and *Sealings* (representing e.g. certificates for OERs). The *Photodentro QS repository* hosts and manages Quality Seals and Sealings for OERs, which reside on various OER repositories, and provides a registry of OER certifiers. Our experiences from its nationwide use are also discussed.

Keywords: Quality assurance, OERs, quality seals, Photodentro seals repository, e-learning.

1. Introduction

Open Educational Resources (OERs) have an important role to play towards achieving *Sustainable Development Goal 4: Quality Education (SDG4),* which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. A major concern, however, is the quality of OERs. The plethora of available OERs could also be considered as a hindrance, sometimes leaving educators "adrift in an ocean of information" without knowing how to easily find quality resources.

In recent years, several frameworks, methodologies, and tools have been developed or proposed for ensuring quality of OERs. Among them, we mention the widely-used LORI (Learning Object Review Instrument) (Leacock & Nesbit, 2007) and LOEM (Learning Object Evaluation Metric) (Kay & Knaack, 2008), both focusing on Learning Objects; the OERTrust framework (Almendro and Silveira, 2018) which recognizes the pedagogical, content-oriented, and technical dimensions in verifying and assuring OER quality; and the SciLOET evaluation tool (Mikropoulos & Papachristos, 2021), which specializes on Learning Objects for Science Education. (Camilleri et al, 2014) provide an overview and analysis of quality issues related to OERs. Among others, they highlight an important issue, namely the federation of responsibility at each step of the OER life cycle, which has resulted from the involvement of many stakeholders; from a quality perspective, this has led to the introduction of federated quality tools, such as peer assessment and social ranking systems. A state-of-the-art overview of quality assurance systems from an international perspective is also provided by (Zawacki-Richter et al, 2020), along with their IQOER Instrument for Quality Assurance of OER. The UNESCO (2019) Recommendation on OER refers also to the significance of quality assurance and encourages member states *"to develop and integrate a quality assurance mechanism for OER into the existing quality assurance strategies for teaching and learning materials".*

The OER movement has led to the development of numerous Repositories of OERs (ROER) whose goal is to *"help educators search for content in a structured way, share their own resources, reuse existing materials, and create new resources through adaptation or translation"* (Atenas & Havemann, 2013). Initial approaches to measuring the quality of OERs in repositories focused on the quality of their metadata (Palavitsinis et al, 2014b), which is an important factor towards facilitating their selection and retrieval. In recent years, however, attention has also been given to the quality of OERs themselves. Two extended and comprehensive literature reviews on quality approaches of OER repositories can be found in (Connell & Connell, 2020) and (Clements et al, 2015). Clements et al. also propose a classification of

quality approaches in OER repositories into three categories, namely generic (e.g. generic quality standards), domain-specific (e.g., quality criteria), and quality assurance instruments (e.g., ratings, recommendation systems, peer reviews). To ensure the quality of OERs, some repositories offer *user evaluation tools* (e.g., star ratings, rubrics), while others have adopted *peer review* as a policy to revise resources and ensure their quality. However, this information (i.e. assessment results, scores) remains within each repository, while in most cases the assessment tools provide users of the OER repository with limited information about the methodology, criteria, or learning context to which this assessment relates.

The concept of Quality Seals has been used to ensure quality in many fields; other similar terms or concepts are *quality stamps, quality badges,* or *certificates*. Electronic quality seals or certificates are nowadays widely used to verify/state that an entity or an object meets the criteria or the process defined, while recent research focuses on their security issues (eIDAS Regulation, ENISA, 2016). Seals of approval have also been used in the domain of Trustworthy Digital Repositories (TDRs); as mentioned in (Donaldson, 2020), *"as visible token of successful certification, repositories are permitted to use seals and certification marks to communicate with stakeholders about their certification".*

In this article, we propose a generic Quality Assurance (QA) framework for OERs based on *Quality Seals* and we introduce the *Photodentro Quality Seals (QS) Repository and e-service,* which hosts and manages: *OER Quality Seal holders* (i.e. certifiers); *Quality Seals* (i.e. documents describing the criteria or the processes defined by a certifier to ensure quality of OERs); and *Sealings* (i.e. certificates for OERs). To the best of our knowledge, this is the first implementation of an online repository of Quality Seals for OERs, which provides an open registry of OER certifiers and openly shared Quality Seals. The *Photodentro QS* was originated and developed by CTI Diophantus, in the context of the "Digital School" Greek National initiative (Megalou & Kaklamanis, 2018), funded by Greek NSRF 2014-2020, and it supports the QA process of the National OER repositories for primary and secondary education.
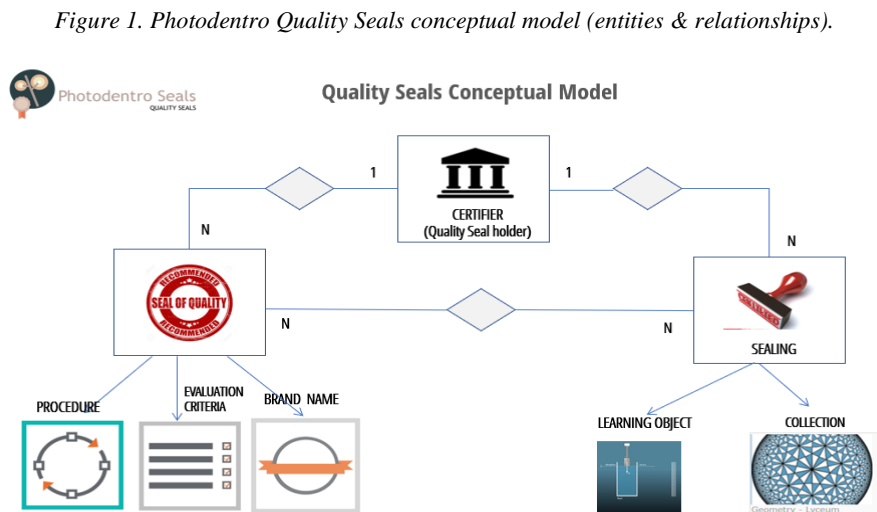
2. Photodentro QS: quality assurance framework for OERs based on quality seals

The "*Photodentro Quality Seals*" (or *"Photodentro QS"*) is a generic conceptual framework designed to support Quality Assurance schemes for OERs and their metadata. The framework is broad enough to accommodate existing quality assurance schemes that have been defined and relate either to quality assurance criteria for OERs or to quality assurance procedures for their design and development.

The basic idea behind the proposed framework is that each quality assurance scheme for OERs defines and can be represented as a "*Quality Seal*". Each body (e.g. certification authority, organization, company, or consortium) who implements or has defined a quality assurance scheme (e.g., a process for designing OERs, or a set of criteria for evaluating OERs) can thus define their own "Quality Seal" that applies to a certain context, purpose, OER use, or target audience, by describing what an OER should meet in order to be awarded it. The Quality Seal is documented with metadata and it is published by its owner on an *open*, digital *repository of Quality Seals*; thus, the quality seal represents itself an *Open Educational Resource*. When users view a quality seal on an OER, they know about the quality assurance process that has been followed for this OER and the body by which its quality is ensured.

2.1. The Photodentro QS conceptual model: main entities and relationships

Figure 1 depicts the conceptual model of the *Photodentro QS framework,* its main entities, and their relationships.

Figure 1. Photodentro Quality Seals conceptual model (entities & relationships).

The Photodentro QS conceptual framework is based on three main *entities (concepts)*:

(a) Quality Seal: It signifies that an OER has successfully "passed" a quality assurance process. It may refer to the quality of *OER itself* or to the quality of *metadata* describing the OER.

(b) Quality Seal holder: A legal entity (such as a certification authority, organization, or company) or a consortium of entities (such as a project) who defines, "owns", and awards quality seals. A Quality Seal holder may own many Quality Seals, each focusing on various quality aspects (e.g. impact, accuracy, relevance) or uses of OERs (e.g. use in class or as reference material). Awarding quality seals to OERs is usually done by authorized persons, who are designated by the Quality Seal owner to handle their quality seal.

(c) Sealing (or stamping): The awarding of a Quality Seal to an OER. It is performed by the Quality Seal holder. A Sealing record is characterized by (i) the Quality Seal and (ii) the information related to the sealing itself, e.g. timestamp or the evaluation outcome. An OER may receive one or more Quality Seals (i.e. it may be subject to more than one sealings). Sealing may be carried out for a single OER or for a group/collection of OERs.

The Photodentro QS framework identifies three *types* of Quality Seals for OERs, depending on *how* the quality of the OERs is ensured, namely:

(a) Procedure: A Quality Seal of this type describes a quality assurance procedure that needs to be followed for the design, development, formative or summative evaluation, testing, or approval of OERs. Although not for OERs, the ISO 9001 standard is an example of this QS type.

(b) Evaluation criteria: A Quality Seal of this type defines a set of qualitative and quantitative pedagogical, scientific, or technical evaluation criteria, based on which OERs are assessed.

(c) Brand name: A Quality Seal of this type indicates a reliable source of origin of OERs.

The Photodentro QS framework also identifies two *categories* of Quality Seals, depending on *what* they relate to, namely: (a) *Object*, if it refers to the quality of the OER itself, or (b) *Metadata*, if it refers to the quality of metadata describing the OER.

3. The Photodentro Quality Seals repository and e-service (Photodentro QS)

The *Photodentro QS* is an integrated web-based platform designed and developed to support the proposed Quality Assurance generic framework for OERs. It is addressed to (a) bodies (e.g. certification authorities), organizations, companies, or consortia (e.g. projects) who implement quality assurance procedures for digital resources, by providing them with tools to describe and publish their Quality Assurance schemes in the form of Quality Seals, and award them to OERs hosted in various online repositories, and (b) users of OER repositories, to be informed about the quality assurance process followed for each OER or search for OERs based on certain Quality Seals. It consists of two web-based environments: (1) An open to everyone *Repository* of QS holders, Quality Seals, and Sealings, and (2) a Quality Seals *authoring environment* for authorized users, to define, share and award Quality Seals.

3.1. Photodentro QS open repository of quality seals, QS holders, and sealings

The Photodentro Quality Seals *Repository* is available at *http://photodentro.edu.gr/seals*. It hosts and manages (a) *Quality Seal holders* for OERs, thus operating as a Registry of OER certifiers, (b) *Quality Seals* for OERs of various types and categories, and (c) *Sealing* records, including the results of applying a corresponding QA process on OERs, timestamps and additional info, such as evaluation files.

Figure 2. Photodentro QS Repository: (a) Quality Seals / Filters, (b) Quality Seal holders; (c) Quality Seal metadata.
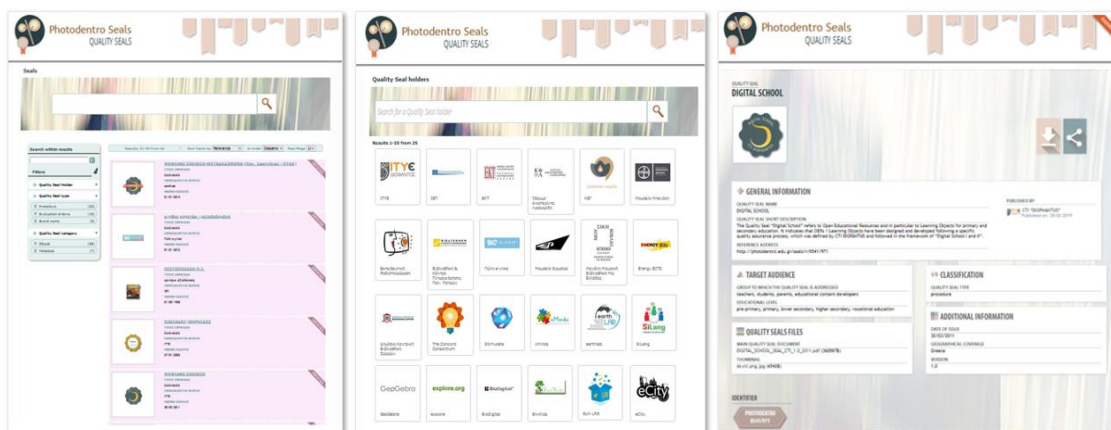
The repository is open to everyone, teachers, pupils, parents, and the general public, to browse, search and display OER Quality Seals, Sealing bodies/Quality Seal holders, or Sealings. Users can search for published Quality Seals for OERs using free-text and keywords, sort out the results, or use filters to refine results based on the Quality Seal holder, the Quality Seal type (i.e. procedure, evaluation criteria, or brand name), or the Quality Seal category (i.e. object or metadata) (see (a) and (b)). Figure 1

An important functionality of the Photodentro QS *Repository*, however, is that it can be interconnected, through open interoperability protocols, with existing online OER Repositories or portals with OERs. In this way, OERs hosted in third-party repositories or portals are enabled to link to open Quality Seals, published and registered in the Photodentro QS repository. Linking an OER to a Quality Seal signifies its "sealing" with this Quality Seal. The Quality Seal logo is displayed on the OER metadata page; when selected, it leads to the Photodentro QS Repository and in particular, to the OER's Sealing record, and through this, to the Quality Seal description page providing all information about it, such as its type, category, authority who owns it, detailed description of evaluation criteria or process, etc.

3.2. Photodentro QS authoring environment for defining and awarding quality seals

Photodentro Quality Seals provides a web-based environment for *Quality Seal holders* to (a) define and describe Quality Seals as well as add metadata, publish, and manage them; (b) award quality sealings to OERs that qualify; (c) authorize people (assessors) to award their quality seal on OERs; (d) store and manage their OER sealings; and (e) manage their profile and identity as a sealing body on the quality seals repository. Each entity of the repository has a handle ID uniquely identifying it.

3.3. An IEEE LOM-based metadata application profile for quality seals

The Photodentro QS repository is based on international standards to ensure interoperability with other platforms. A metadata Application Profile based on IEEE LOM standard was defined to describe and classify all three entities of the Photodentro QS repository, namely Quality Seals, Quality Seal holders, and Sealings, as well as to support filtering according to various aspects of these entities.

The metadata scheme for **Quality Seals (QS)** includes the following elements per LOM category:

General: *identifier* (the unique identifier of the quality seal in the repository); *title* (the quality seal name); *brief description* (what the quality seal concerns, in which context, etc.); *geographical coverage* (the country/ies where the quality seal is valid or appropriate); *reference address* (URL of the quality seal metadata page in the repository).

Lifecycle: *version* (the version of the quality seal, e.g. 1.0, 2.0); *published by* (the sealing body that published the quality seal); *date of issue* (the date the quality seal was issued).

Educational: *target audience* (group to which the quality seal is addressed); *context* (the educational level of OERs for which the quality seal is intended).

Classification: *category* (category of the quality seal, either object or metadata); *quality seal type* (procedure, evaluation criteria, or brand name).

Quality Seal files: *thumbnail* (the Quality Seal logo icon); *Quality Seal document* (the main document file describing the Quality Seal). Depending on its type, i.e. procedure, evaluation criteria or brand name, the QS main document file presents respectively: (a) the procedure to be followed for the design, development, evaluation or approval of the object, in order for the OER to qualify for the Quality Seal; (b) the set of evaluation criteria, qualitative and quantitative, on the basis of which the object is evaluated and graded; the threshold for its approval is usually provided; (c) information on the validity and reliability of the source of OERs.

The metadata scheme for **Sealings** includes elements such as: *identifier* (the unique identifier of the sealing within the repository); *brief description* of the sealing; *reference address* (URL of the sealing record in the repository); *sealed by* (the Sealing body / Quality Seal holder who awarded the quality seal to the OER); *Quality Seal* (reference to the Quality Seal with which the sealing was made); *timestamp of sealing* (date and time on which the award of the quality seal to the OER took place); a *thumbnail* (the icon of the OER sealed, with the mark "Sealed"); and *Sealing files*, which include documents certifying the award of the quality seal to the OER, such as certifications or relevant decisions.

3.4. An example: the "digital school" quality seal

As an indicative example of a Quality Seal, we mention the "*Digital School QS*" that CTI DIOPHANTUS has defined and published on the Photodentro QS Repository. This QS refers to interactive open Learning Objects for primary and secondary education and it defines the QA "*procedure*" followed for their design and development in the "Digital School" national project. In this context, OERs are designed and developed by groups of experienced, highly qualified teachers, under the scientific guidance and supervision of a Scientific Coordinator (an academic with significant domain and pedagogical expertise). The process includes the following steps: (a) Needs and requirements *analysis*

(concepts, topics or modules that the learning object is called to support) based on bibliographic documentation and educational experience; (b) *pedagogical design* (collaborative negotiation and feedback from all team members for the content and shaping of pedagogical and technological characteristics); (c) *technical design* and implementation; (d) continuous, internal *formative evaluation* of the OER (comments and suggestions by team members for corrections and improvement), which implies multiple cycles of pedagogical and technical design, implementation, critical commentary, and technical testing); (e) *pilot evaluation* of the prototype; evaluation dimensions include: content, user-interface, pedagogical design, added value, technical and functional characteristics; (f) *approval / acceptance* by the scientific coordinator. The Digital School QS includes also a special part, which specifies the process for each subject/domain. Figure 2 (c) presents the metadata page of this QS.

4. Nationwide use of the Photodentro quality seals repository: results and next steps

The Photodentro Quality Seals Repository currently hosts 43 OER Quality Seals, provided by 25 Sealing bodies. Among them, 36 Quality Seals refer to OERs and 6 to metadata quality. As for their type, 23 Quality Seals describe a QA procedure, 5 are based on evaluation criteria and 15 define a trustful source of origin. CTI Diophantus has published 11 Quality Seals, all of them of type "procedure".

The Photodentro Quality Seals Repository has been linked to the Greek national OER Repositories of the Ministry of Education and the national OER Aggregator (photodentro.edu.gr) for primary and secondary education, which contains 17,000 OERs from 19 external OER repositories. The application of the various quality assurance schemes on these OERs, as defined by the corresponding Quality Seals, has resulted in 37,450 *sealing* records for OERs. When browsing the OER repositories, users can see whether a selected OER has received a quality seal, of which type, and from which body (or bodies); read the detailed description of the quality seal that includes its methodology, criteria, or context; study the assessment results; or search OERs by *Quality Seal*s or *Quality Seal holders.*

Next steps include the creation of the European, multilingual edition of the Photodentro Quality Seals Repository and e-service to operate as a European repository of Quality Seals for OERs and registry of Quality Seal holders, as well as linking to other OER repositories at the European level.

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