

The Case of Spain

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1. Introduction^[1]

Geographically and politically, Spain forms part of the European Union and is located in Southwestern Europe. Internally, it is a constitutional monarchy composed of 17 autonomous communities and two autonomous cities. However, the Government of Spain is the central government, which also establishes the national policies for all areas of the society, including education. The autonomous communities and cities have varying degrees of autonomy to put into practice those policies. The Spanish population is around 47 million inhabitants, and the official language is Spanish, although some autonomous communities have co-official languages (Aranese, Basque, Catalan and Galician), which are also considered within the educational laws and educational curriculum.

Being education an essential issue to regulate, there has been a succession of educational laws with each government change since the start of the democratic period of Spain's history (1975) until nowadays, although many of them never came into force. The most recent one corresponds to the educational law approved in 2020. These educational laws regulate only the pre-university educational levels, since different ministries are responsible for these levels (Ministry of Education and Vocational Training) and higher education (Ministry of Universities).

Changes in the universities' law have been not as often as the educational laws, and the current one corresponds to the year 2001 – with a modification in 2007 -, although a new law is being currently worked on (draft bill published in August 2021, approval expected in the first half of 2022), in order to address the challenges of the Spanish University of the XXI century, deal with structural problems, and being pioneer in the changes from social, economic, cultural, scientific, technological contexts and from all other disciplines. The current universities' law provides higher education institutions with the autonomy to create and propose study programs according to the established rules. However, the curricula leading to obtain a degree must have in the centre of their objectives the acquisition of competences by the students, and emphasis must be placed on the learning methods of these competences as well as on the procedures to evaluate their acquisition. In addition, the existence of quality assurance systems, leading to accreditation processes of university degrees, should be guaranteed. Finally, each Spanish autonomous community decides on the university fees per credit and study program of the public universities of its provinces.

In terms of structure, as in other European countries, the Spanish higher education system is structured in 4 years with 240 ECTS in the undergraduate programs, which could be optionally followed by a postgraduate program (Master) with 60-120 ECTS and a doctorate program. The system also comprises university and professional studies (advanced vocational training).

The [Spanish university system](#) is made of 84 universities, among which 50 are public and 34 are private. Six out of the total are completely online and, except one of them – the National University of Distance Education, UNED - all of these universities are private.

The number of students and study programmes has increased every year. Data from the academic year 2020/2021 (Ministerio de Universidades del Gobierno de España, 2021) shows that the Spanish universities had 1,309,742 undergraduate students (55.6% women and 5.8% foreign students), 234,214 postgraduate students (55.6% women and 23.1% foreign students) and 89,353 doctoral students (50.1% women and 27.4% foreign students). Regarding the university staff, 125,471 were teaching and research staff, 63,281 administrative staff and 26,408 research staff. The offer of the Spanish higher education system consists of 3,008 degree programs (bachelor), 3,638 master programs and 1,156 doctorate programs.

According to the annual report "Digital Society in Spain" (Martín Carretero et al., 2019), Spain has a strong commitment with digital transformation and is one of the best-connected countries in the world, being leader in the deployment of the fibre optic broadband in Europe and the third country among the OCDE countries. While this digital transformation is clearly leading in some areas (e.g., digital public services), some others have still room for improvement, and this is the case of education, especially noticeable in schools with the COVID-19 pandemic in the most recent report (Fundación Telefónica, 2021).

In the context of higher education, the document approved in January 2021 by the Conference of Vice-Chancellors of Spanish Universities (CRUE) constitutes a proposal for debate of the University 2030. Digital transformation is a key concept in this document and has a specific section devoted to it, as an element linked to the change of the organisational model and to reach a cultural change (CRUE, 2021). Challenges include educational technologies and online training, training/accreditation of digital competences, decision making based on information analytics, electronical administration, academic certifications of diplomas and competences, and the digital transformation from the perspective of the leadership at the universities (strategic plans for digital transformation). In addition, the document refers to the report "360° ICT, Digital Transformation in the Spanish University", which presents a roadmap for Spanish universities based on six pillars: 1) vision, which addresses how digitalisation can help and provide value to the organization; 2) the transformation of the university processes through the application of ICT; 3) the (online) interaction formats with the students (interactions through new channels, like social media, with almost 24/7 availability); 4) the design of services due to new realities like Big Data or Internet of Things (e.g., learning analytics' services); 5) a new model of university, that combines virtual students' support and personalized support, use of MOOCs; and 6) a change in the culture of the organization, which includes thinking differently, promoting innovation, among others (Cabrero et al., 2017).

Against this background, as well as current general and specific developments in digitalisation, this book chapter provides an overview of the digital transformation in Spanish higher education at the macro, meso and micro level. The macro level will explore further aspects related to the national context and infrastructures; the meso level will cover the regional (autonomous communities) and institutional contexts; and finally, the micro level will address teaching and learning processes, and specifically explores faculty's perceptions and awareness regarding (O)ER infrastructures and actors. While most of the methodology followed in the study corresponds to desktop research (through available literature, official documents, institutional websites, other related websites, etc.) and content analysis (e.g., open access and OER policies in the meso level section), the major data source of the micro level are the findings of an empirical survey conducted by the author of the report that covers a representative sample of the faculty's population in Spain (400 full answers) across 64 universities out of the 84 total. The exploration of these three levels will provide the reader with main insights of (O)ER infrastructures, and policies, measures for change and quality issues regarding to those infrastructures, in the Spanish higher education system and institutions.

2. Macro level

2.1 (O)ER Infrastructure

The digital infrastructure in Spain is mostly centralised, although there are also infrastructures for each autonomous community, which will be described in the Meso level.

One of the most relevant players for higher education at the national level is RedIRIS, which stands up as the Spanish academic, research network that provides advanced communication services to the national scientific community and universities starting from 1988. It is funded by the Spanish Ministry of Science and Innovation but it is managed by a public corporate entity called Red.es (Spain Ministry of Energy Tourism and Digital Agenda, 2017), which is an agency of the Spanish Ministry of Economy and Business (Ministerio de Economía; Industria y Competitividad, n.d.). This agency is also the promoter of initiatives like “Escuelas conectadas” (Networked schools) in the school context and Actívale in the context of university MOOCs. The affiliated institutions with RedIRIS are over 450, for the most part universities and public research centres (Ministerio de Economía; Industria y Competitividad, n.d.). The infrastructure state-wide services offered by RedIRIS includes, among others, the connectivity-related services such as IPv4 and IPv6 routing and multicast content distribution, private networks to connect research groups in different geographic locations as if they were on the same networks via virtual and optical circuits and the roaming [service](#).

Another key agent in the context of digital repositories is FECYT, which is a public foundation managed by the Ministry of Economic Affairs and Competition that, by applying the principles of rationalisation, transparency and efficiency, endeavours: to develop instruments of social participation in support of science; to be a suitable tool for the spread of science and the growth of scientific culture; to become the channel for communication with the Spanish scientific community overseas; and to become the benchmark of Spanish R&D metrics (FECYT, n.d.-b). This foundation has built an infrastructure of Open Access scientific repositories (RECOLECTA), which is described later.

Relevant previous initiatives

The project ARCA or RSS Aggregator for the Academic Community was conceived as a federation of metadata on multimedia contents and scheduled broadcasts offered by the members of the national academic and research network RedIRIS. Its aim was to introduce those contents to the academic community, since most of them were being unnoticed due to the lack of means at that time. The project was originated at the University Carlos III of Madrid.

As a feeds aggregator, the system collected automatically the information in xml (RSS 2.0) documents that the affiliated institutions elaborated with their contents and integrated in the database to be shown to the user in an intelligible and navigable way. Therefore, the users could subscribe to the ARCA portal’s news through RSS. ARCA is the predecessor of RECOLECTA.

The OCW-Universia supported universities with technical support and a content management system based on eduCommons, an US open source project for the creation of OCW projects. This system had specifications based on the IEEE standards 1484.12.1-2002 Learning Object Metadata Standard (IEEE LOM) and ISO 15836 Dublin Core Metadata (Dublin Core) and allowed universities to import/export courses and materials in IMS packages.

Current state of digital infrastructures of educational repositories

Educational repositories in Spain are receiving more attention at the school context, where [Procomún](#) stands out as the national repository.

Procomún is a repository of OER created by the Ministry of Education, Culture and Sports (MECD) and the Spanish autonomous communities that integrates school learning objects, teaching experiences and communities. The educational community (both teachers and students) can find and create structured, open educational resources in a classified standardized form (LOM-ES). Procomún includes a search engine that allows users to find learning objects through multiple criteria and a teaching social network linked to the educational resources through social labelling and user feedback, among others (INTEF, n.d.). Other initiatives include the platform of the National Centre of Curricular Development in non Proprietary Systems ([CEDEC](#)), which has as aim to design, promote and develop digital educational resources for schools through open source software; the portal of the National Institute of Educational Technologies and Teacher Training (INTEF), and Agrega, as the precursor of Procomún. Additionally, most of the Spanish autonomous communities have also developed their own OER portals (García & Calle, n.d.). Since 2015, the program of “Escuelas conectadas” is still an important initiative derived from the agreement between the Ministry of Economy and Business

and the Ministry of Education and Vocational Training, to a great extent financed by the European Regional Development Fund, in order to generalise the high speed broadband connectivity in schools (Martín Carretero et al., 2019).

In higher education, the national project RECOLECTA should be mentioned. In addition, initiatives regarding MOOCs are highlighted.

[RECOLECTA](#) or Recolector de Ciencia Abierta (Open Science Harvester) is aimed at creating a nationwide infrastructure of Open Access scientific repositories, which also include educational resources. It is configured as a platform that gathers all the national scientific repositories together in one place and provides services to repository managers, researchers and decision-makers. RECOLECTA is the result of the collaboration between the Spanish Foundation for Science and Technology (FECYT) and the Network of Spanish University Libraries (REBIUN) run by the Conference of Vice-Chancellors of Spanish Universities (CRUE) since 2007 (FECYT, n.d.-b).

The objectives of RECOLECTA are (FECYT, n.d.-b):

- To promote and coordinate the national infrastructure of Open Access digital scientific repositories in an interoperable manner based on the standards adopted by the global community.
- To foster, support and facilitate the adoption of Open Access policies by all researchers from R&D centres and universities.
- To give greater visibility, and both domestic and international application of the results from research carried out in Spain.

Interoperability between Open Access repositories is only possible if the deposited files use a common storage and exchange of information's language and, that is what RECOLECTA ensures, by requesting all repositories to comply with international standards for interoperability. Repositories that want to be harvested in RECOLECTA should meet the RECOLECTA-DRIVER Criteria (described in the section of Quality), which are based on the DRIVER (Digital Repository Infrastructure Vision for European Research) Guidelines and the OpenAIRE Guidelines (European directives). The RECOLECTA-DRIVER Criteria includes two levels of interoperability: one is the syntactic use of OAI-PMH (Open Archives Initiative-Protocol Metadata Harvesting), which ensures the resource to be harvested correctly, and the second one is the semantic use of OAI_DC vocabularies.

Regarding the (O)ER based on MOOCs, many Spanish universities use [MiríadaX](#), which is a platform for Iberoamerican MOOCs in Spanish supported by the private telecommunications company Telefónica Learning Services based on Madrid (Oliver et al., 2014; Oliver Riera et al., 2015). As private and for profit platform to offer courses, the [Spanish Tutellus](#) is based on a model in which the commercial courses do not have publication cost and the course coordinator receives around the 80% of direct benefit from the incomes regarding enrolments. Some Spanish universities that do not have presence in MiríadaX offer free contents through this platform (Oliver et al., 2014). Other platforms where some universities are offering MOOCs are [Activate](#), which was promoted by Google Spain -from May 2019 by Google Ireland- and the Spanish Ministry of Industry, Trade and Tourism; and Educablab -now [AprendeIntef](#)- which is an initiative of the INTEF of the Spanish Ministry of Education and Vocational Training (Martín et al., 2015).

2.2 Quality of OER

The study by Medrano et al. (2012) on the status of digital repositories that implemented the OAI-PMH protocol in Spain and the quality of its metadata provided as conclusions that:

- The major issue is a product of orthographical and typographical inconsistencies and the lack of control mechanisms, e.g. titles and descriptors too long, diverse ways to refer to the same language or type of file.
- Many data providers use automatic tools for generating metadata of their resources; others give this task to low-qualified people or different persons that apply diverse criteria when loading the data; and there are also providers that only obtain metadata from external sources.
- There are repositories that fill out all the fields but not in the right way and vice versa.

National quality standards in adherence to international standards are addressed to improve the situation of digital repositories of educational resources in higher education in Spain.

Actors in national quality assurance

UNE is the Spanish Association for Standardisation endorsed by the Internal Policy of the Ministry of the Interior of Spain since its foundation in 1986. The main Spanish business association, top Spanish companies and a significant representation of Public Entities from all levels are members of UNE (UNE, 2018). In 2017, it was divided into two organisations: the Association with the same name (UNE), which is the legal entity in Spain devoted to the development of standards; and AENOR, which is a commercial entity for evaluation and certification of the compliance of standards, and also a society of UNE. AENOR also offers training with the same purpose (AENOR, 2019).

Another relevant actor in national quality assurance of digital educational resources is the work group of repositories of [REBIUN](#), the Spanish Network of University Libraries, which has been working on studies and reports concerning the status of digital university repositories in Spain (Santos-Hermosa, 2017), including a recent guide in 2021 to evaluate institutional [repositories](#).

The work group of trends in educational resources and quality criteria in new learning environments of [CRUE](#) should be mentioned as a third author in the overview of national quality assurance.

National quality standards

There are two main national quality standards in the field of digital educational resources, both of them developed by UNE: the 71361:2010 and the 71362:2017.

The standard UNE 71361:2010 is related to the standardised labelling of digital educational resources. It includes a list of categories for this labelling and a descriptive table with the different elements of the aggregated and simple data that belong to each category with its corresponding definition. For each element it is indicated (INTEF, red.es, & Spanish Autonomous Communities, 2010, p. 4):

- The character of the element: compulsory, recommended, optional and/or conditioned.
- The type of data (e.g., vocabulary).
- The values space for controlled vocabularies.
- The size, which sets the minimal allowed maximum of elements.
- The order, to define if the order of the list of instances is relevant or not, with the following values: not specified, ordered or disordered.

The objective of the work done to implement this standard is to design and develop a reference framework for the creation of educational repositories based on standardised digital objects, which could be reusable and transferable. Based on the international validated and accepted standardisation initiative Learning Object Metadata (LOM) of the Learning Technology Standards Committee (LTSC) created within IEEE, LOM-ES was developed as a metadata schema that considers and satisfies the specific needs of the Spanish educational community (INTEF, red.es, & Spanish Autonomous Communities, 2010, p. 3).

The basic structure of LOM-ES is based on the nine original categories of LOM v1.0 and has being modified in some of each elements, as follows (INTEF et al., 2010, pp. 4-6):

- General: description of the (O)ER. Information related to the technical and expressive characteristics of the media-based (O)ER, and its level of aggregation, are included.
- Life Cycle: characteristics of the history and current state of the (O)ER.
- Meta-metadata: information on the own metadata instance.
- Technical: requirements and technical characteristics of the (O)ER. The vocabulary of names for operating systems and web browsers has been extended.
- Educational: educational characteristics of the (O)ER. The modifications in this category affect the elements with extended vocabularies: type of educational resource, recipient, context, description and cognitive process.
- Rights: intellectual property rights and conditions of use of the (O)ER. New extended vocabularies are incorporated for the elements of authors' rights and access.
- Relation: characteristics that define the relation between this (O)ER and other related (O)ER.
- Annotation: it allows to include comments about the educational use of the (O)ER and information on when and by whom were created those comments.
- Classification: it describes the (O)ER in relation to a concrete classification system. New taxonomical sources are generated for the classification purposes: educational level, competence, accessibility and discipline.

The second Spanish standard is the UNE 71362:2017. Teaching and learning, technology, accessibility and educational experts from the academic sector, the business sector and the public administration were involved in its creation. It provides guidelines to define and assess the quality of digital educational materials quantitatively and qualitatively (Fernández-Pampillón Cesteros, 2017). Fifty-six national and international quality models formed the basis for the first version of the quality model of the standard. The standard defines a digital educational material of quality as being effective from the pedagogical perspective -good academic results are obtained when the materials are used with reasonable teacher or student effort or dedication-, technological view -simple, reliable, and transparent use-, and accessibility point of view -ease of access and use by any individual, with or without disabilities- (Fernández-Pampillón Cesteros, 2017, p.1). The UNE 71632 norm offers quality indicators to be scored and a rubric to guide this score, as well as guidelines to help with the evaluation. The different criteria of the quality model and tool measure are presented in Table 1.

Table 1

Quality criteria for digital educational materials (Standard UNE 71632). Source: adapted from Fernández-Pampillón Cesteros (2017, p.2), free translation by the author of this report.

Dimensions

Pedagogical effectiveness	Technological effectiveness	Effectiveness regarding accessibility
Pedagogical description (pedagogical value and coherence)	Format and design	Structure of the learning scenario
Quality of the contents	Reusability	Navigation
Ability to generate learning	Portability	Operability
Adaptability	Robustness: technical stability	Accessibility of audiovisual content
Interactivity		Accessibility of text content
Motivation		

Derived from these quality criteria, a quality assessment tool for digital educational materials has been developed, which is aimed at four types of users (Author/Creator, Consumer/User, Reviewer/Evaluator, and Supplier/Distributor) and has two different application profiles (adaptations of the quality tool): teacher and student (Fernández-Pampillón Cesteros et al., 2017).

On the other hand, the quality criteria of RECOLECTA should be mentioned as a part of national quality standards related to open access resources.

The guide for the evaluation of institutional research repositories is based on international criteria, being the main reference OpenAIRE (Open Access Infrastructure for Research in Europe), and aims at ensuring interoperability of all the open access resources and a quality access to their contents (FECY et al., 2014). The basic elements include the implementation of OAI-PMH (definition of compulsory and recommended requirements) to solve problems in different implementations of open access repositories, the requirements to be met by the resources and the Dublin Core mandatory and recommended elements (Metadata). Though this guide is focused on institutional research repositories, some guidelines may be also applicable to digital educational materials sometimes deposited in those institutional repositories.

The guide defines 53 evaluation criteria for the repositories, regarding visibility -through its presence in national and international directories and of a normalised name-, policies, legal aspects -regarding intellectual property of the contents distributed-, metadata -metadata characteristics and format that the documents should have-, interoperability, logs and statistics, and security, authenticity and data integrity (FECYT et al., 2014). While some of those criteria are basic and mandatory, others are just recommended. All have closed answers with values of Yes or No to evaluate if the repository complies them or not.

Concerning metadata evaluation criteria, there are some rules that should be applied in order to be harvested in RECOLECTA (FECYT et al., 2014):

- The metadata format OAI-DC is used.
- All the items have the field title (dc:title), description (dc:description) and type of publication (dc:type). This latter has to be assigned according to the type of documents and vocabulary OpenAIRE (European directive) with the document version.
- All the items have the field publication date (dc:date) and it is presented in the established format (norm ISO 8601 - AAAA-MM-DD).
- All the items have the field authors' rights (dc:rights) and information of the level of access, according to vocabulary of types OpenAire.
- All the items have the field author (dc:creator), a field of format (dc:format) according to the registered list of IANA (types of media of Internet- types MIME).
- All the items have the field language (dc:language) according to the established vocabulary (ISO 639-3).
- All the items have the field identification (dc:identifier).
- An indexation policy known by the authors where it is established exists: language used, keywords, etc.
- A system of normalised classification is applied (e.g., CDU, UNESCO).
- The metadata exportation is allowed in another format than Dublin Core Simple.
- Some format of technical and/or conservation metadata is used.

In order to be included in [RECOLECTA](#), the Repository Manager for each repository should follow the next steps (FECYT, n.d.-c):

1. Ensure that the resources in the repository are involved in these categories: Institutional repository, Thematic repository, Magazine portal or Journals owned by an institution without institutional repository.
2. The resource must accomplish standardized quality criteria (RECOLECTA-DRIVER Criteria) so that records can be located. Some of them were already mentioned before (metadata evaluation criteria) (FECYT et al., 2014), others appear in the mentioned document regarding the OAI-PMH protocol (FECYT, n.d.-a): size of set between 100 and 500 records, implementation of an elimination strategy (transitory or persistent), the dates' format coincide, progressive delivery of records, minimal lifetime for the "ResumptionToken" of 24 hours and a valid email address of the repository manager.
3. Access to RECOLECTA [Validation & Harvester Tool](#). The access by the repository manager will be checked via OAI-PMH.
4. If the resources are suitable, it is possible to ask to be harvested. RECOLECTA managers will verify that the first and second steps have successfully been completed before harvesting the resource.
5. Resources harvested can be located through the RECOLECTA [search engine](#).

CRUE-TIC published an initial report on their work on MOOCs and the criteria to evaluate them that included a preliminary evaluation, the evaluation of the MOOC model in terms of quality and the evaluation of its sustainability. The report includes a proposal to be reviewed of criteria of pedagogical quality for the elaboration of MOOCs at the universities and two questionnaires: one for experts on the quality and sustainability of MOOCs and another more general for the university community as MOOCs users. The indicators for quality criteria of MOOCs in the proposal are formed by three dimensions: planning/management (administration, accreditation), learning design (instructional design, contents, resources and activities, evaluation) and communication-interaction (communication, mentoring) (CRUE-TIC, 2015).

2.3 OER Policy

There are no specific national policies regarding digital infrastructures for digital educational resources in higher education and their implementation. However, three laws have some influence on this topic: the Spanish Law 14/2011, of 1st June, on Science, Technology and Innovation, entitled "Open Access Dissemination"; the Spanish Law 37/2007, of 16th November, on the reuse of information in the public sector, which obeys the European Union directive 2003/98/CE; and the Spanish Law 11/2007, of 22th June, on the electronic access by the citizens to the public services. In addition, the Spanish Education Law should also be mentioned.

The main actor involved in national policies regarding digital infrastructures and their implementation in Spain is the same public government and, more concretely, the Ministry of Science and Innovation.

Other actors that are contributing to the development of policy with guidelines and recommendations in reports and working papers are the CRUE, the REBIUN, the FECYT and the CEOE (Spanish Confederation of Corporate Organisations).

National policies

The Article 37 of the Spanish Law 14/2011, of 1st June, on Science, Technology and Innovation, entitled "Open Access Dissemination", defines the basis at a national level for the publication of research activity in Open Access repositories when it has been mostly funded through the General State Budget of Spain (public funding) (FECYT, 2011). The Ministry of Science and Innovation is responsible for providing centralized access to those repositories, and its connection with similar national and international initiatives. This responsibility derives in the RECOLECTA initiative that was previously explained. Although this policy addresses research repositories, institutional repositories often include both research objects and digital educational resources.

The Spanish Law 37/2007, of 16th November, on the reuse of information in the public sector, has clear consequences on digital educational resources, since it establishes that the exercise of the intellectual property rights of the public organisms and administrations should be done in a way that eases the reuse of that information, concretely by offering the possibility of its free usage or giving them a license. This law ensures that the amount of data that derives from

organisations and projects financed with public funds or created by a public institution is made available to society (García & Calle, n.d.).

In the Article 42 of the Spanish Law 11/2007, of the 22th June, on the electronic access by the citizens to the public services, a national scheme of interoperability (ENI) was planned. This establishes the set of criteria and recommendations to be taken into account for decision-making technological interoperability (Portal of Electronic Administration Political Ministry Territorial and Public Function General Secretariat of Digital Administration, 2010).

Within this framework, the Article 111.bis of the Spanish Law 2/2006, of 3rd May, on Education, addresses aspects that affect digital educational resources. Some of the highlights are: 1) the objective of establishing standards that ensure the interoperability between the different information systems used in the Spanish Educational System, 2) the establishment of formats by the Ministry of Education, Culture and Sport, with previous consultation with the Autonomous Communities, that should be supported by learning tools and support systems in the context of the public digital educational resources. The objective is to ensure its use with independence of the technological platform where they are hosted (Spanish Government, 2006). In addition, the same Article states that the Ministry of Education, Culture and Sport will offer digital and technological platforms of access to the educational community, which will be able to incorporate educational resources from the educational administrations and other actors for its shared use. This statement continues by specifying that those resources should be selected according to parameters of methodological quality, adoption of open standards and availability of sources that ease its dissemination, adaptation, reuse and redistribution, being recognised as such. These statements are kept in the most recent modification of the Education Law that came into force in 2021.

The Spanish Law of Universities does not specify anything related to this topic and the Spanish General Law of Telecommunications only mentions that public universities are prioritised in terms of having an improved network connection (Spanish Government, 2014).

Working papers

There are also some documents that work as recommendations for the development of policies.

For instance, the CEOE establish in their "Digital Plan 2020: the digitalisation of the Spanish society" the prioritisation of the transformation of the educational system to adapt it to the new digital society, by putting the focus on learning and the use of the opportunities of technologies. One of the proposals include the promotion of MOOCs in higher education for new knowledge as a way to create synergies between the universities and the companies that require that knowledge (CEOE, 2016).

The CRUE publishes periodically reports that address the digital transformation in the Spanish Higher Education system and pose guidelines / recommendations, e.g.:

- "Towards an open university. Recommendations for the Spanish University System", which deals with open government, open data and open access of the universities and poses some best practices from different Spanish universities (CRUE, 2014).
- "ICT 360°, Digital Transformation at the University" (Cabrero et al., 2017) and "UniversiTIC 2017. Analysis of ICT in Spanish Universities" (Gómez Ortega, 2017), which inform about the trends regarding digital transformation at the universities and propose strategic action lines.

From the library' side and with the support of the CRUE, REBIUN published the report "Educational Open Resources: state of the art and guidelines for its promotion in Spanish Universities", which focuses on the results of a questionnaire answered by universities regarding the situation of the institutions regarding educational repositories, open licenses and institutional incentives / policies for its use, among other aspects. At the end, the report provides a series of recommendations for the promotion of open educational resources in Spanish universities that concerns, e.g., the interoperability among platforms or the creation of a specific policy for open educational resources (Santos-Hermosa et al., 2019).

Within the line of the report "Towards an open university. Recommendations for the Spanish University System" by the CRUE, the FECYT published a brief paper on recommendations "Towards an open access by default" to support the implementation of the Article 37 of the Spanish Law 14/2011, of 1st June, on Science, Technology and Innovation, entitled "Open Access Dissemination", focusing mainly on research publications (FECYT, 2017).

On the other hand, the document "Digital Spain 2025" - presented in 2020 - as an up-to-date agenda that promotes the digital transformation of the country contains a collection of measures, investments and reforms, in their deployment may also bring new insights to the policies to be developed in Spain regarding infrastructures for digital resources.

2.4 (O)ER Change

Change agents

The major agent for change in the field of digital educational resources and its infrastructure is the Ministry of Science, Innovation and Universities. It defines the main challenges to address in R&D, which in turn establish the calls for research projects to be funded with public budget to which companies, universities and other institutions can apply. One of those current challenges was entitled "Economy, Society and Digital Culture" and includes a focus on the Internet of Things, digital infrastructures and 5G networks, smart services and applications, cloud computing and big data, high performance computing, natural language processing, cybersecurity and digital identity, applications for the digital tourism and digitalisation of the cultural heritage (Ministerio de Economía; Industria y Competitividad, 2017).

Other agents involve private entities, such as telecommunications companies, banks and, mainly associations and foundations (NGOs).

However, most of the change specifically regarding digital educational resources is not happening at this macro level, but rather at the meso and micro level, with funding schemas coming from the autonomous communities and the same universities. As noted in the report by Fundación Cotec para la innovación (2018), the R&D funding is not keeping pace with the economic growth in Spain, in terms of public and private investment. A timid trend towards private investment for R&D has been identified in the last years.

Funding schemes

Among the funding schemes to promote change in this field, the calls for R&D projects and other initiatives, and awards for the creation of (O)ER can be highlighted.

Previous national calls of the Ministry of Science, Innovation and Universities for R&D projects oriented to the society challenges focused on contributing to solutions to social, economic and technological problems in a mainstream way and on publishing its results in forums of high scientific and technological impact, enabling the technology transfer and internationalising their activities (Ministerio de Ciencia; Innovación y Universidades, 2018). It included as one of the topics "Digital economy, society and culture". The budget was of 268,198,000€ to distribute to three or four-years' projects.

On the other hand, the Ministry of Economy and Business published a call for R&D in the field of digital enabling technologies, which relates to the challenges of the economy, society and digital culture previously described. These technologies refer to ICTs of high impact and disruption capability, strategic for the development and the digital transformation of the economy and the society, e.g. Internet of Things, Big Data, Blockchain, supercomputing, cloud computing, natural language processing, robotics, cybersecurity, biometry, artificial intelligence or virtual reality (Ministerio de Economía y Empresa, 2019). The budget was of 9 millions of euros for subventions and loans addressed to universities and/or companies.

Between 2008 and 2013 an agreement between the CRUE and Red.es enabled the launch of the program "Profesionales digitales" (Digital professionals) with three calls for Spanish public universities with the objective of encouraging the national industry of digital contents (videogames, animations, mobile contents, virtual reality, advanced video and audio, etc.) through the creation of Centres for Production and Experimentation, but also for the development of training

programmes, of collaboration between universities and the industry, and sharing and dissemination actions like the creation of a portal to ease communication and knowledge exchange and the launch of a federated repository of digital contents (CRUE & Ministerio de Industria; Turismo y Comercio, 2011). The digital contents developed by the universities should be stored by themselves but the metadata were to be accessible according to the bibliographic publication standards (OAI-PMH, RSS,...); the interoperability between the generated digital content and the different content delivery systems and virtual campus, but also its independence should be guaranteed. Those metadata would be exported to the federated and central repository, which would rely on the federated identity management systems used in the eduroam system. The program was framed in the Plan for the Promotion of the Digital Content Industry, which was included in the initiatives of the "Digital Agenda for Europe" and the Strategy 2011-2015 of the Avanza2 Plan. According to the third call, the first and second calls funded 21 and 10 universities, respectively. The maximum amount of the Program in this last call was of 8,000€ to be jointly financed by Red.es and the universities (50% each). Regarding to the sustainability of the program, Red.es was stated as the responsible of maintaining the communication portal and the repository, whereas the universities should ensure that the executed actions within the program would be operational within the next 5 years of its launch.

Some private companies are also pushing universities towards change in the form of calls for R&D projects oriented to the areas defined by the challenge "Economy, Society and Digital Culture". One of them is the telecommunications company Vodafone, through its program Vodafone Campus Lab, which funded a maximum of 3 projects of 50,000€ to be developed in one year related to the following topics: artificial intelligence applied to predictive telecommunications radio network, improvement of the 5G network and data analytics/big data (Vodafone, 2018).

Another is the BBVA Foundation, which is financed by the BBVA bank, which offers a call for research projects in different areas, among them digital economy and society, digital humanities and big data. Five projects can be funded in each area during 2 years, with 75,000€ each and 100,000€ in the case of the big data area (Fundación BBVA, 2018).

From the NGOs' side, the Hergar foundation is worth to be mentioned. This is an organisation devoted to the educational research and promotion, which also has an annual call for R&D projects in the fields of application of ICTs in adult learning and health sciences; applied and technological research in social and law sciences, and humanities, and applied and technological research in engineering studies. This call is also open to other educational/business/scientific institutions and offers a maximum of 5,000€ for one project in each field during a year (Fundación Hergar, 2019).

Aside research funding and the program "Profesionales digitales", the creation of OCW sites by the universities before the creation of MOOCs has also been recognised in the form of awards.

Since 2007, OCW-Universia encouraged universities to join the OCW Consortium and provided them with technical support and infrastructure. The agreement between OCW Universia and the universities was based on the development of the OCW site by the universities, with at least 10 courses that followed the principles of OCW. According to Frías-Navarro et al. (2014), the main problem in this initiative (and its sustainability) was the lack of incentives for participation, neither official recognition for the teachers nor economic support were offered. However, between 2007 and 2014, in order to motivate teachers to participate in the initiative, each year the award MED-Universia for the best courses offered in the institutional OCW was announced and university teachers could apply for it. This prize was promoted by OCW-Universia with the sponsorship of the Ministry of Education and Science (Aranzadi, 2011; Universia, 2014). As an international initiative to which also Spanish universities participating in the OCW-Universia project could apply for between 2011 and 2014, the "Awards for OpenCourseWare Excellence (ACE)" of the OCW Consortium are worth to be mentioned. Several Spanish Universities OCW sites and courses were recognised with those awards (OEC, n.d.).

Between 2015 and 2018, the Tordesillas Group, an academic network formed by universities from Brasil, Portugal and Spain with the aim of scientific and educational cooperation, published an annual call for awards for the creation of MOOCs. These MOOCs had to count with the participation of university teachers of at least 2 universities of the Group, and of different countries. The prize included the required support and assistance for the development and

implementation of the MOOC with an appropriated level of quality, and had the sponsorship of the bank Santander (branch universities) and the travel agency The Travel Brand (Grupo Tordesillas, 2018).

Also, between 2015 until 2018, the association for the development of the educational technology and new technologies applied to education Edutec, which is constituted by Spanish and Iberoamerican universities and founded in 1993, launched the prize Edutec-Fundación Da. María Paula Alonso de Ruiz Martínez with the sponsorship of the Spanish foundation Da. María Paula Alonso de Ruiz Martínez. The aim of this prize was to acknowledge educational innovation with ICTs and educational professionals from any educational level could apply for it (Edutec, n.d.)

Not many of the public or the private initiatives seem to put emphasis on the sustainability of the projects, reducing their evaluation and control to the lifetime of the project.

Other measures

The National Agency for Quality Assessment and Accreditation of Spain (ANECA), as the organism in charge of issuing certifications that enable professionals to apply for professorships (permanent positions) in Spanish universities, has also some influence on change in this field.

It included, though with a low score, the creation of own teaching material in any kind of format as one of the merits to obtain the accreditation to work as Assistant and Associate Professor (Profesor Ayudante Doctor and Profesor Contratado Doctor): 7 and 9 points out of 100, respectively (ANECA, 2007).

The elaboration and teaching of an online course in standing platforms like OCW, EdX or Coursera is also a complementary merit to obtain the accreditation to work as Full Professor in some of the fields of knowledge (e.g. in social sciences) (ANECA, 2017).

3. Regional and institutional infrastructures for digital educational resources (meso level)

3.1 (O)ER Policy

As noted earlier, Spain has mostly a centralised higher education system, which implies that the Higher Education Law applies for the whole country. However, autonomous communities and universities are given certain degree of autonomy in developing some specific regulations under the national laws.

Here the policies in the autonomous communities and in the universities that have some connection to (O)ER are highlighted.

Policies in the autonomous communities

Certain autonomous regions in Spain have Open Access mandates already, mostly focused at scientific and academic production, namely:

- Region of Madrid: the Official Gazette of the Region of Madrid, N° 53, of 4 March 2009, contains the publication of Order 679/2009, of 19 February, which defines the regulatory basis for grants aimed at R&D programmes among research groups in the Region of Madrid and technology grant announcements co-financed by the European Social Fund ([B.O.C.M.](#) of 4 March 2009)

Article 7 of said Order states the policy on promoting Open Access to the results from scientific research promoted by the Region of Madrid (FECYT, n.d.-b).

- Principality of Asturias: besides the creation of an Institutional Repository, the Principality of Asturias has adopted a series of specific measures to foster its use and facilitate access to scientific information, the distribution thereof and the preservation thereof in all those areas in which public resources are used. The 12 January 2009 the [Council](#) adopted policies to promote the development of Open Access to the Principality of Asturias research (FECYT, n.d.-b).
- Autonomous Community of Catalonia: Since 2009 [\[2\]](#), the Catalan Interuniversity Council (CIC), composed by all Catalan universities, agreed on carrying out several actions to foster open access at the university level. The aim was that academic promotion and research projects evaluation system takes only into consideration those publications included in an open access repository. Although this has not become completely true, most of the universities ask their faculty to publish pre-print versions of their works in their institutional repositories, ensuring their open access.

Open Access and Open Education policies at the universities

At the university level, 64.2% of the higher education institutions (34) had an Open Access Policy, which means that universities have decided in favour of open access dissemination (Santos-Hermosa et al., 2019). Surprisingly, the same report indicates that 52.9% of these policies did not include any recommendation or obligation for open access publication.

Most of the universities do not have a specific policy for OER [\[3\]](#), as this kind of resources do not have any special consideration by the institution or because the policies were created for research, not for teaching and learning. Nevertheless, Santos-Hermosa et al. (2019) point out the fact that several universities (30%) were planning to develop new strategies to correct this situation and to foster OER publication, through support calls with publication incentives; mostly as part of institutional digitalisation strategies that the universities have developed.

As mentioned before, 34 of the Spanish universities had Open Access policies and mandates already (mostly public ones), and in their mandates they mention the platforms where the resources are placed (FECYT, n.d.-a). In some of the cases these policies make special reference to educational resources. In Table 2, a summary of the universities with open access policies and their publication dates, as well as the mention to (O)ER - if appears -, is provided. Other universities that are not listed may have the development and use of (O)ER as part of the university strategic areas. This is for example, the case for the Universidad Internacional de Andalucía ([UNIA](#)) or the Universidad Carlos III de Madrid ([UC3M](#)).

Table 2

Summary of universities with open access policy and mention to (O)ER. Source: own elaboration based on FECYT (n.d.-a).

Universities	Open Access Policy (date of publication)	Mention to (O)ER?
Universidad de Almería	Yes (2017)	No
Universidad Autónoma de Barcelona	Yes (2012)	Yes. Teaching staff is encouraged to deposit educational resources in the institutional repository .
Universidad de Alcalá de Henares	Yes (2013)	No
Universidad de Alicante	Yes (2006)	Yes. The own repository includes teaching as one of its areas and accepts teaching material in any language, including learning objects, handbooks, teaching

Universities	Open Access Policy (date of publication)	Mention to (O)ER?
		units, exercises, teaching guides .
Universidad de Barcelona	Yes (2011)	Yes. It is mentioned that the academic community is encouraged to deposit those contents in the institutional repository and to participate in open dissemination projects, such as, for example, OpenCourseWare .
Universidad de Burgos	Yes (2014)	No
Universidad de Cantabria	Yes (2012)	Yes. It recommends including them in open repositories and participate in open dissemination projects, such as for example at that point was OpenCourseWare, but also other similar initiatives that could be developed .
Universidad Complutense de Madrid	Yes (2014)	Yes. It is stated that the teaching and research staff of the UCM will be able to deposit in the institutional repository their teaching materials or other materials that are not published according to the quality criteria set by the UCM and its centres .
Universidad de Extremadura	Yes (2013)	Yes. Among the institutional context of open access, the educational resources are specifically included .
Universidad de Girona	Yes (2012)	No
Universidad de Granada	Yes (2016)	No
Universidad de las Islas Baleares	Yes (2014)	Yes. it is stated that the teaching and research staff are encouraged to deposit in the institutional repository other academic publications different from the scientific ones (e.g., educational materials) done within the teaching activity of the UIB. The deposit in open access of other learning objects that could be interesting for students or teachers is also promoted .
Universidad de León	Yes (2011)	Yes. It states that the members of the community of the university must deposit other academic publications done within the teaching activity of the university in the institutional repository. It is also promoted the deposit in open access of all the learning objects that could be of interest for students or teachers .
Universidad de Lleida	Yes (2012)	Yes. It is specified that the teaching and research staff are recommended to deposit an electronic copy of their publications (teaching materials included) in the institutional repository of the university and, if corresponds, in the open access teaching material repository UdL OpenCourseWare. If they are published with an open access license in UdL OpenCourseWare, the institutional repository collects them .
Universidad de Málaga	Yes (2013)	No
Universidad de Huelva	Yes (2015)	Yes. It is specified that the teaching and research staff will be able to deposit their teaching materials and other not published materials done during their academic activity and that could be of interest for the students in the institutional repository. These materials will be subject to open access licenses Creative Commons .
Universidad de Sevilla	Yes (2014)	No

Universities	Open Access Policy (date of publication)	Mention to (O)ER?
Universidad de Valladolid	Yes (2016)	Yes. The teaching and research staff of the university will be able to deposit their teaching materials and other not published materials done within their academic activity and that could be interesting for the students (learning objects) in the institutional repository .
Universidad de Vic	Yes (2012)	Yes. It is specified that the teaching and research staff are recommended to deposit their academic and research publications (teaching materials included) produced during their activity at the UVic in the institutional repository of the university .
Universidad de Zaragoza	Yes (2013)	Among the institutional context of open access, the university includes specifically the educational resources like OpenCourseWare or others.
Universidad Politécnica de Cartagena	Yes (2010)	No
Universidad Politécnica de Cataluña	Yes (2009)	No
Universidad Politécnica de Madrid	Yes (2010)	Yes. It encourages the publication of academic and scientific documents from UPM instructors and students, in its repository and in the digital collection .
Universidad Politécnica de Valencia	Yes (2011)	Yes. It is specified that the university will incentivise their teachers to disseminate the learning objects generated within their teaching activity in the open through the institutional repository .
Universitat Pompeu Fabra	Yes (2011)	No
Universitat Rovira i Virgili	Yes (2013)	No
Universitat Oberta de Catalunya	Yes (2010)	The academic community of the UOC must deposit their academic publications (teaching materials or educational modules) done within their teaching activity in the UOC in the institutional repository. The deposit with open access of all the learning objects that could be of interest for students or teachers is also promoted. If they are published with an open access license in the OCW of the UOC, the institutional repository collects them (UOC, 2010, p.3).

All the universities with open access policies have similar written commitments, including the coordination with institutions of the university system in order to allow national (i.e. RECOLECTA) and international (i.e. DRIVER) academic and research production collectors to index the produced knowledge by the universities and provide access to it. This implies the use of standard protocols of exchange of metadata (i.e. OAI-PMH, Dublin Core).

Three institutional cases stand out: Universitat Oberta de Catalunya (UOC), Universidad Internacional de la Rioja (UNIR) and UC3M, which are described further as follows. The first two ones are completely online and private universities and have major (O)ER policies - UOC with longer trajectory than UNIR -, where as the UC3M is a traditional and public university that has been a pioneer in the development of OER in Spain due to an advantageous supportive context to open education.

The UOC

The UOC has an open access policy since 2010 and in 2019 launched its Open Knowledge Plan as a path to follow to become a fully open institution: from teaching to research; from publication to dissemination, to reach by 2030.

The Open Access policy of the UOC is one of the most comprehensive of all the universities with this kind of policy. It specifies different conditions depending on the belonging to the different university groups: research community, academic community, doctoral students and other students (degree or master). Only the ones that refer to the academic community mention (O)ER. The teaching materials are to be published first under copyright during a specific time period, after which they are published with a Creative Commons license (UOC, 2010).

The Open Knowledge Plan establishes 6 main work areas (Universitat Oberta de Catalunya, 2019): open publications, FAIR data, open learning, open innovation, open to society and evaluation research models. Regarding open learning, copyright during six semesters is by default applied to the learning courses produced at the UOC, but the possibility to publish them open is possible from the beginning - however, only 4% of the new learning courses were asked to be published in an open format from the start. The intention within this work area according to the Plan is to move from a closed model with open educational materials as an exception by default towards an open model with the possibility to make exceptions in copyright. It is clearly stated at this point in the Plan that there is an intention of commitment towards OER: "we commit ourselves to promote the use and creation of OER" (Universitat Oberta de Catalunya, 2019, p. 18). Later in the document, it is also stated that the use of open platforms as open knowledge spaces and open management, including the promotion of the use of open source software, will be promoted (Universitat Oberta de Catalunya, 2019, p. 22).

The UNIR

The UNIR developed its own Open Education policy (UNIR, n.d.), through the Research Institute for Innovation & Technology in [Education](#), in which specified that the institution's vision towards Open Education is focused on every form (OER, data, research results, policy, licensing, technology and content authoring) to reach by 2020.

As the policy states, "Open Education becomes a key part of the university's strategy to combine Open, Universal and Free content (OUF) with proprietary services, and to find a balance between economic profit and social benefit" (UNIR, n.d.). UNIR encourages both staff and students to "use, create and publish OE resources and services to enhance the quality of the student experience, enhance the provision of learning opportunities for all, and improve teaching practices".

The strategic priorities of the policy are five: P1) increase the amount of UNIR resources released as OER, P2) integrate existing OER as appropriate into UNIR courses, P3) support the creation of OER as academic resources, P4) develop an open access approach for UNIR research data, and P5) contribute to the awareness of open education into society and the academic community at large.

Regarding the UNIR priorities of the open education policy, the ones related to OER are highlighted (UNIR, n.d.):

P1: UNIR will gradually increase the amount of current educational resources released as OER, up to 40% of the total broadcast by text and video. UNIR will implement an open policy to release learning resources, lessons, video-casts, open classes and other educational material, incrementally, every academic year, from various faculties, scientific fields and degrees. Whether or not OER are used or published in a school or service will ultimately be a decision for the rector and the exec board. Where use, creation and publication are to be restricted, schools and services are encouraged to identify and communicate a rationale for restriction. The University reserves the right to remove resources that do not comply with its policies, and/or request removal of resources from external [repositories/sites](#).

P2: UNIR will increase the use and re-use of existing OER within UNIR courses to the level that 60% of course materials are comprised of OER, and utilized as part of the teaching-learning process. UNIR teaching staff will be trained online and through seminars on how to identify, evaluate, adapt and share

relevant OER within their teaching activities. Online open resources, after a quality check, will be combined with academic, proprietary materials, so that students, authors and lecturers are encouraged to integrate both approaches into a successful learning flow. Other OER repositories will be integrated for a bi-directional relation, so that OER can be freely shared. Cross capacity-building actions will be put in place through courses, open classes and workshops dedicated to Open Education and [OER](#).

P3: At least 20% of all UNIR learning material produced by faculty will be created and distributed under open licences. UNIR teaching staff will be trained in Open Education and equipped with knowledge, skills and technologies to produce OER. The university will encourage faculty and students to create and publish OER to enhance the quality of the student experience, provided that the resources are fit-for-purpose and relevant. Whether or not OER are used or published in a school or service will ultimately be a decision for the rector and the executive board. Where use, creation and publication are to be restricted, schools and services are encouraged to identify and communicate a rationale for restriction. The university reserves the right to remove resources that do not comply with its policies, and/or request removal of resources from external [repositories/sites](#).

Concerning the recommendations for [faculty](#), first it is established that the responsibility to ensure that they have the necessary knowledge and rights to publish an OER and that all such resources published comply with all relevant policies lies on the staff and the students. Then the staff and the students are advised to publish OER using a Creative Commons attribution licence (e.g., CC-BY), and other Creative Commons licences (e.g., to add a non-commercial use or share-alike element) may be used if the creators feel this is necessary or appropriate for their particular resource, or to comply with the licence of any third-party content used in the resource. Recommendations include the publication of written and interactive digital teaching resources in an appropriate repository or public access website in order to maximize discovery and use by others, or link or federate them from the university repository to other repositories. Concretely, audio/video-based OER teaching resources are to be published at the University's multimedia repository. In addition, faculty and students are encouraged to collect data where possible on the usage of their OER. Special mention is made to students producing OER as part of their programme of study or within a faculty-directed project; in that case the policy guidelines should be followed and OER should be checked by a member of staff before publication (UNIR, n.d.).

The UNIR policy refers also to sustainability as key activity, along with networking and dissemination. Collaboration with national and international partners to ensure the correct implementation of the policy are mentioned, including the support of the UNESCO Chair on eLearning and the ICDE Chair on Open Education [Resources](#).

The UC3M

According to Vida Fernández and Webster (2014), the fundamental guidelines of open education are part of the university's philosophy, concretely,

sharing, reducing barriers and increasing access to education. The development of open education activities at the UC3M has been determined by two circumstances that have fostered the creation of open courses. Firstly, the broad experience of its teachers for more than a decade in the use of information technologies thanks to the university's Virtual Learning Environment (Aula Global) that has encouraged faculty to digitize their teaching materials and put them online for their students. Secondly, the change in the teaching and learning methodology brought about by the new programs designed according to the criteria of the Bologna Process to adapt them to the European Higher Education Area. UC3M was one of the first universities to adhere to the Bologna Process, so since 2008 a more practical approach to teaching based on continuous formative assessment has become widespread, which has led teachers to create their own teaching materials. This favorable context has allowed UC3M to successfully develop its open education policies. (Vida Fernández & Webster, 2014, pp. 146-147)

As in other Spanish universities, OEW was the first OER initiative to be set up at the UC3M in 2006. This project helped to foster an open publishing culture among faculty members and has been a catalyst for other OER initiatives. UC3M

has won several awards of excellence for the quality of its OCW courses by Universia and the OpenCourseWare Consortium. Subsequent initiatives include UC3M MOOCs in MiriadaX (2013) and in edX (2014).

Institutional digital strategies

Only few universities have developed or were developing digital strategies and plans to boost the digital transformation of the institutions. For example, as to July 2019, the Universidad de Murcia presented its Digital Strategy that includes five strategic lines and 20 [objectives](#): transform users in ambassadors, build alliances that improve the university's competitiveness, transform data into managed assets, innovate through agile and intelligent experimentation and adapt the value proposition before it is too late. Based on this strategy a Digital Transformation Plan was developed in [2021](#) to give place to operational plans with concrete actions. Among the strategic line "transform data into managed assets", the integration and enhancement of the data quality of the different units is the main [objective](#). Consistent with its first strategic line, the website for the institutional strategy includes an open section for participating in the strategy.

The Universitat Jaume I (UJI) started a process for the design of the digital plan in 2018 with the aim to guide and promote the process of digital transformation of the university in all its missions (initial and continuous training, research and knowledge creation, and dissemination among all the social sectors), with special emphasis on the training [aspects](#). In the Digital UJI Plan, published in March [2020](#), four main action lines have been highlighted: the identification and promotion of the digital competence (students, faculty members and staff), the promotion of digital and online education, transfer and communication of digital identity for visibility of research, and the digitalisation of processes and digital services.

In an incipient phase, the Universidad de Salamanca Digital as the digital strategy of the university set up as main [objectives](#): follow the guidelines of the European Convergence process, guarantee citizens' access to university administration, break down the barriers of access to the knowledge of the university (space, time and money), gain international presence and serve students from all over the world, and climb up the world rankings.

Other universities have a vice-rectorate of digital transformation, which would be connected to the development of a digital plan in the future. For example, the vice-rector of Digital Transformation at the Universidad de Extremadura includes as competencies, among [others](#): the actions towards the digital transformation in training, research and management of the university, training actions for the whole university community in terms of ICT, the push towards designing and coordinating online and blended learning studies, as well as the creation, development and maintenance of technological infrastructures.

Although only a few universities were found to start moving towards the development (and implementation) of a digital strategy plan at the institutional level, many of them included strategic lines related to digitalisation within their institutional strategic plans.

3.2 OER Change

Change agents

From the Santos-Hermosa et al. (2019) report, the most important change agent at the universities is the Library (84.9%) and people working there. This is easy to be given since one of the functions of the library is to have any institutional document classified and easily accessible. Other minor agents are Technology and Computer Services, Faculty and the Virtual Campus Services.

As a library agent, the area of libraries, information and documentation (until 2013, CBUC) of the Consortium of University Services of Catalonia (CSUC) is also to be acknowledged. The CSUC shares academic, scientific, library, transfer of knowledge and management services to associated entities to improve effectiveness and efficiency, and it is formed by ten Catalan universities (Universitat de Barcelona, Universidad Autónoma de Barcelona, Universidad Politècnica de Catalunya, Universitat Pompeu i Fabra, Universitat de Lleida, Universitat de Girona, Universitat Rovira i Virgili, UOC, Universitat de Vic-Universitat Central de Catalunya, Universidad Ramon Llull) and the [Catalonian government](#).

In some of the universities, some schemes for incentivising the creation and use of (O)ER are also identified as an aim (derived from the digital plans of the universities), but they have not always been carried out. Although the university board fosters these decisions, the unit that takes responsibility is the Library, for example:

"The UdG Library will facilitate the introduction of documents into the repository by providing the necessary support. This action will be done at no cost, since the Library will assume this task as it has been doing until now." (Universitat de Girona)

"The University will adopt the incentivising measures that could consider with incidence on assessment and funding of projects. Regarding the repositories, both those owned by the university and those being shared cooperatively, the university is committed to facilitate through its Library all the necessary support for getting the documents introduced into the repositories." (Universitat de Vic)

"The University will adopt the appropriate incentivising measures –funding of the departments, consideration in the support calls, etc.- addressed at the accomplishment of the mandate of 1st of January 2012." (Universitat de Lleida)

Virtual Campus Services receive different names among institutions, and some of them are important agents regarding providing support to faculty in order to produce (O)ER. Sometimes also in combination with IT Services.

For example, the Centre of Education and New Technologies (CENT) of the Universitat [Jaume I](#) offers university teacher training and support for the use of the institutional learning management system and multimedia tools. Similarly, the Digital Campus of the Universitat de les Illes Balears, offers university teacher training (but also student support to use the institutional learning management system) too, and support for videoconferences the production of multimedia learning materials, such as podcasts, videos, websites, [etc.](#)

Another example is ULLmedia, which is responsible for producing promo videos, informative videos, and educational videos for the Universidad de La Laguna, as well as for offering advice on how to prepare scripts and audiovisual materials, and how to successfully share content across the [network](#).

In the case of the UC3M, two important working groups were set up to establish a stable and coordinated basis for furthering the creation, use, dissemination and preservation of OERs and supporting instructors in the process (Malo de Molina, 2013):

- MaREA. This is a multidisciplinary working group composed of professors who are specialists in Intellectual Property Rights, Open Access and OERs and interactive technologies; as well as members of the Library and Communications and Computing Services. Its aim is to define policies and strategies for creating, managing and disseminating quality educational resources.
- UTEID (Unit for Educational Technology and Innovative Teaching). This is a unit that is integrated in the Library Service with support from the Communications and Computing Service and the Undergraduate Management and Academic Support Service, to a) support faculty in creating educational resources, using new educational technology, and protecting, preserving and disseminating these resources; b) evaluate platforms and tools for course design, content creation and student evaluation. It supports teachers participating in projects such as Khan Academy Zero Courses, MOOC-UC3M and MOOC-Universia. (Vida Fernández & Webster, 2014, p. 147)

Other minor change agents at this level are the Group 9 of Universities, the Network of OER and open education in Spanish (Red de Recursos Educativos Abiertos y Educación Abierta en Español, REA-Net) and the Cátedra Santander-UA of Digital Transformation.

The G-9 is a non-profit association formed by nine Spanish public universities (Universidad de Cantabria, Universidad de Castilla La Mancha, Universidad de Extremadura, Universitat de les Illes Balears, Universidad de La Rioja, Universidad de Oviedo, Universidad del País Vasco, Universidad Pública de Navarra and Universidad de Zaragoza) that has as objective the promotion of collaboration between the universities that belong to the group, in terms of teaching and research activities and [services](#). The teaching activities include the development of training courses for students and university teachers in a shared platform.

REA-Net was based on Madrid and had as main aim to promote information networks and contact about open education in Spanish-speaking countries with the objective of promote cooperation between its members and place OER in the formal academic contexts.

The Cátedra Santander-UA of Digital Transformation is a unit created within the University of Alicante and with the support of Santander Bank in order to establish a centre for reflection, debate and research in the field of the adaptation of society to the digital [age](#).

Funding and prizes schemes

In Spain, there are several partial public funding schemes for the elaboration of open educational resources at the primary and secondary school level, but universities usually fund with their budgets any initiative regarding this kind of resources. An exception was a funding scheme from the Junta of Andalucía, in Southern Spain, which supported, in 2005, projects on educational resources by a total amount of 12.000€ each. Although the funding scheme was addressed to public schools, universities were also included [\[4\]](#).

As examples, some experiences related to fostering the creation and publication of OER at the institutional level can be mentioned as follows.

Universitat Jaume I

As an action connected to the digital plan and the trajectory of the university promoting open educational projects, the Universitat Jaume I had an annual call for the elaboration and publication of open teaching materials (OER) in the teaching collection "Sapientia" (manuals) and in the OpenCourseWare of the university ([multimedia courses](#)) and another one to support the elaboration and teaching of MOOCs [\[5\]](#) (total funding: 18.000 €; plus a symbolic honorarium: 180-720€). OER were to be published in the institutional repository, as part of the corresponding collection: "Sapientia" or "OCW". MOOCs too. The university would disseminate the open materials using an open license of Creative Commons, preferably CC BY-SA. Support for creating the multimedia materials was offered within the OER and the MOOC calls through two procedures: 1) teaching video recordings using the classrooms with multimedia table; in this case the postproduction was responsibility of the author and the IT service would support in the problems that could appear regarding formats and tools to be used; and 2) teaching video recordings at the LABCOM with the means that would be established for the purpose; in this case it is needed to book a time slot to do the recordings and postproduction would not be done. Regarding the implementation and teaching of a funded MOOC, the call stated that the university would provide the technical means and needed support.

Universidad de la Laguna

It has calls for the creation of digital educational [materials](#), [MOOCs](#), and educational innovation [projects](#). The university also offers prizes for best teaching innovation projects, which have been MOOCs in some cases. Technical support is offered by the multimedia service of the university in terms of technical questions related to the production of the digital educational materials and providing information and counselling regarding the intellectual property of the contents (teachers can choose among three options for their Creative Commons license). OERs must be published in the institutional repository, the virtual campus and the multimedia channel, if corresponds. The teaching vice rector offers support to the participants regarding the organisation, content structure, technical and methodological aspects of the MOOCs through their technical support units. MOOCs will be published on the MOOC platform of the university and in MiríadaX with the license CC BY NC ND.

Universidad Politécnica de Valencia

In its institutional strategic plan 2015-2020, the elaboration, dissemination, visibility and accessibility of information and results are included as a strategic [project](#), which with regard to (O)ER, considers: 1) the production of digital contents, 2) the organisation of digital contents in the institutional repository, and 3) the promotion of MOOCs.

The university has created the Online Teaching Plan (Plan de Docencia en [Red](#)), in order to incentivise instructors to create digital and reusable educational materials and publish them in the institutional repository. This Plan includes an

annual [call](#) with a total funding of 35.000 € (plus a symbolic honorarium: 20-400 €). The OER to be created could be: digital learning objects (polimedia recordings, screencast recordings, educational videos, virtual laboratories or teaching articles), learning modules (with one or more learning objects), videonotes, and MOOCs.

The same Plan also publishes an annual [prize](#) for acknowledging the best quality and use of the produced materials in the previous call.

Universidad de Alicante

The Institute of Educational Sciences offers an annual call to support educational innovation projects for the promotion of blended and online teaching, including support to university teachers for the development of MOOCs (Massive Open Online Courses) and NOOCs (Nano Open Online Courses), and support for the faculties to develop blended and online teaching and learning processes in the official study programs of the [university](#). Among the conditions for the publication of those educational resources is that they should be released with a Creative Commons license and disseminated through the institutional repository (with the possibility to host the materials in other open platforms).

Universidad Carlos III de Madrid

As in other universities, the UC3M offers an annual call for the development of OCW for faculty. The OCW office of the university devised a system to provide teaching staff with the necessary resources for DIY course production, such as induction sessions, eduCommons (CMS) Workshops, Help Desk (e-mail, telephone, face-to-face), as well as manuals and reference guides (Webster & Pardo, 2011).

Institutional projects

Here we mention some funded projects related to (O)ER related to specific universities or to interuniversity collaborations where Spanish universities were involved:

- OpenMed: Opening up Education in [South-Mediterranean Countries](#). It was an Erasmus+ Capacity Building in Higher Education project (2015-2018) directed at widening participation and adoption of OER and Open Educational Practices (OEP) as a bottom-up approach to support the modernisation of the Higher Education sector in the South-Mediterranean. The project involved an international consortium composed by five partners from Europe and nine from South Mediterranean Countries, including two Spanish universities (the UNIR and the Universidad de Sevilla).
- Open Educators [Factory](#) is an UNIR project that explores how to transform university educators from “agents of resistance” into “agents of change” for Open Education. As part of the project, a platform to allow university educators to self-assess their capacity and level of development in terms of Open Education and to provide them with some guidelines to further adopt openness in all dimensions of their activities was developed.
- [#metaOER](#) was an UOC project (2012) with the main aim of developing a simple system (using Web 2.0 tools: Delicious) to centralise open resources about OER.
- Authorship model of OER for versioning (RAO) was an UOC project (2011), which challenged the traditional interpretation of (O)ERs understood as developed by experts and closed, lasting and created as a fragmented process from different perspectives (pedagogical, economic and [technological](#)).
- OportUnidad was a Latin-American project in which the UOC took part (2012-2014). The main objective was to contribute and maintain a common space between the higher education of Latin-American and the European Union through an ascendant approach, and also and specially to increment the use of open educational practices and resources (OEP and [OER](#)).
- OERTest (Testing an Open Education Resource Framework for Europe) was an Erasmus LLL project in which the UOC and the Universidad de Granada took part – along with the University of Duisburg-Essen. The objective was to develop standards for the OER offer, including guidelines for the evaluation of the work done by the students through those resources, quality standards, management models, [etc.](#)
- DIPROMOOC ([2019-2022](#)). This is a national funded project carried out by the Universidad de Sevilla that aims at the design, production and evaluation of T-MOOCs (hybrid between xMOOCs and cMOOCs, putting the focus on the development of tasks by the students) for the teachers' development (all educational levels) of teaching digital competences.
- colMOOC ([2018-2020](#)). This was an Erasmus project in which the UOC, the Universidad de Valladolid and Telefonica Education Digital are involved. The project aimed to deliver innovative MOOCs with the integration of services based on conversational agents and learning analytics.

Other minor institutional projects could be acknowledged as part of the annual calls of some universities to create and publish (O)ERs, which can be observed in the decisions of the same calls or in the institutional repositories.

For example, a teaching innovation project was developed collaboratively between the Universities of Cantabria and Oviedo for a year (2014-2015) with the aim of promoting awareness of MOOCs and analysing them within the context of some educational degree programmes; and then using this preliminary analysis and developing it with the aim of establishing a MOOC Best Practice Guide (Calvo Salvador & Rodríguez-Hoyos, 2016).

Other measures

Some of the autonomous communities have their own professorship accreditation schemes, which are only valid in the community where it was published, while the national professorship accreditation scheme from ANECA is valid for all the autonomous communities in Spain.

For example, the Catalan University Quality Assurance Agency (AQU) includes as part of the teaching merits for a tenure-track lecturer, to have created and published teaching materials in different fields (social sciences, natural sciences), and to have participated in teaching innovation [projects](#). Most of the accreditation agencies include both activities as teaching merits.

On the other hand, most of the actions that are stated in the university open access policies point towards actions related to the libraries, and include the need for interoperability between repositories.

For example, the open access policy of the UOC includes as interoperability protocols the following: The institutional repository uses the DSpace free software application, the technical characteristics of which are adapted to the ISO 14721:2003 Open Archival Information System (OAIS) reference model. The UOC undertakes to follow the current standard metadata exchange protocols (OAI-PMH, OAI-ORE and SWORD) and those that may appear in the future in order to increase the visibility and interoperability of the repository's contents (UOC, 2010, p.6).

Formal recognition in the form of certificates or authorship acknowledgment is also a usual way of promoting change. For instance, the funding calls of the Universidad de la Laguna mention the acknowledgement of the authorship of the OERs and MOOCs through certification after publishing the materials in the institutional platforms. Similarly, the funding calls of the Universidad de Alicante include the certification of having conducted a teaching innovation project.

3.3 OER Infrastructure

As mentioned in the macro level, the last report UNIVERSITIC published by Conference of Vice-Chancellors of Spanish Universities (CRUE) includes an overview of the situation of infrastructure in 49 Spanish universities (out of 84, but including 84% of the university students in Spain) as of December 2016 [\[6\]](#).

The results regarding the IT basic infrastructure show that 83% of the universities have classrooms with multimedia projector and wireless Internet, 87% have professional rooms for recording and producing multimedia content and 90% of the institutions have IT support services for teaching - 78% for the elaboration of teaching materials. In addition, above 90% state that the teaching staff is using the institutional learning platform and 90% have institutional software licenses. The cooperation between Spanish universities is made clear through the 49% that provide IT infrastructure to other higher education institutions (Gómez Ortega, 2017).

Regarding digital repositories, 88% of the universities affirm to have an institutional repository- mostly developed with open-source software-, among which 80% specify to have institutional digital teaching materials in their repositories, but the percentage is reduced to 61% when talking about open institutional digital teaching materials. Other digital contents refer to MOOCs initiatives (85% of the universities have some offer related to MOOCs) and multimedia portals with digital contents for teaching (a Youtube channel, iTunes) (with 81% of the universities).

According to another report with answers from the 70% of universities affiliated to CRUE (Santos-Hermosa et al., 2019), the universities show overall interest in publishing their educational resources. 88.7% publish them in a closed virtual campus and the 77.4% in an open institutional repository; others publish the educational resources in OpenCourseWare (OCW) (34%), consortia repositories (15.1%), local repositories (11.3%) and others (1.9% corresponding to MOOCs, blogs, etc.). This report also remarks the high percentage of teaching materials in open access and the common practice of duplicate publication of open educational resources and incompatibility among platforms (virtual campus and open repositories). This duplication can be also seen in external platforms (Youtube, Slideshare, Issuu).

Regional networks or consortia

One of the biggest HE networks that involves Spanish universities (79), but also Iberoamerican ones, is Universia, which is supported by the Santander Bank (Frías-Navarro et al., 2014). Between 2007 and 2011, Universia promoted the project OCW, by offering support to universities to develop their own OCW. Up to 2011, 44 Spanish universities published 1,331 OCW courses in their institutional sites (Aranzadi, 2011). Although some universities still maintain and/or feed their OCW sites, many have already closed their OCW sites and/or replaced them MOOCs (Martín et al., 2015; Oliver et al., 2014).

Another Higher Education (HE) network related to (O)ER, the G-9 shares a virtual learning platform based on Moodle where elective courses for students and professional development courses for instructors are offered for free from any of the 9 universities involved in the network.

In the macro level report, REBIUN as the university library network and RedIris as the provider for infrastructure in the universities were mentioned. In this meso level, CSUC (Consortia of University Services of Catalonia) can be mentioned as the manager of e-infrastructures for universities and research centres in the autonomous community of Catalonia.

One of those infrastructures are the digital repositories for university data, including research and teaching repositories (some of them being described as follows); and the libraries services.

There are different HE consortia related to sharing repositories at the university level:

- MDX (Materials docents en xarxa – Learning Materials Online) (<https://www.mdx.cat/>). This is an (O)ER cooperative repository shared by 9 Catalan universities (UB, UAB, UPC, UPF, UdG, UdL, URV, UOC and UVic) and a Valencian university (Universitat Jaume I) with the aim of increasing the visibility and promotion of the teaching production of the participating institutions, of contributing to educational innovation and to free access to knowledge. MDX is supported by the CSUC. The repository is based on DSpace and uses the interoperability protocol of the Open Archives Initiative (OAI). The basic metadata collected per item is as follows:

dc.contributor.author	Universitat de Barcelona. CRAI
dc.date	2016-10-10T17:18:31Z
dc.date	2016-10-10T17:18:31Z
dc.date	2018-09-26
dc.date.accessioned	2019-10-22T03:26:49Z
dc.date.available	2019-10-22T03:26:49Z
dc.date.issued	2019-10-22T03:26:49Z
dc.identifier.uri	http://hdl.handle.net/2445/68287
dc.format	3 min.
dc.format	video/mp4
dc.language.iso	cat
dc.rights	cc-by (c) Universitat de Barcelona. CRAI, 2016
dc.rights	info:eu-repo/semantics/openAccess
dc.rights	http://creativecommons.org/licenses/by/3.0/es/
dc.subject	Formació d'usuaris
dc.subject	Universitat de Barcelona. CRAI
dc.subject	Universitat de Barcelona. CRAI Unitat de Serveis a Usuaris
dc.subject	CRAI Audiovisual
dc.title	Com accedir als recursos electrònics: revistes, llibres i bases de dades [vídeo]. Curs 2018-19
dc.type	info:eu-repo/semantics/other

- [TDX](#) (Tesis Doctorals en Xarxa – Theses and Dissertations Online), cooperative repository of doctoral theses in digital format defended in any of the 16 participating universities (mostly from Catalan-speaking autonomous communities: Catalonia, Valencia and Balearic Islands; and Andorra). Since 2011, TDX takes part in the cooperative [MetaArchive](#) with the objective of preserving doctoral theses, which is done through the LOCKSS program. The doctoral theses in TDX are described with metadata Dublin Core and follow the interoperability protocol OAI-PMH (Open Archives Initiative-Protocol for Metadata Harvesting). This repository is also supported by the CSUC.

Two platforms constitute the main infrastructures for MOOCs at the institutional level:

- [MiriadaX](#), which includes MOOCs from both universities in (mainly) Ibero-American countries, as well as from companies/organisations. Currently many of the courses have a fee for enrolment and certification, which is verified by blockchain. 31 Spanish universities (out of 84) were involved in the publication of MOOCs in MiriadaX ^[7]. It is supported by the private telecommunications company Telefónica Learning Services based in Madrid and Universia.
- Coursera MOOCs of 5 Spanish universities, being three of them business schools and two of them universities in Barcelona.

UCATx was a consortium of universities in Catalonia that used Open edX technology for providing MOOCs, supported by the CSUC. It closed in favour of the major platforms, like MiriadaX and Coursera.

Another consortium for MOOCs in Spain is [UniMOOC](#), which was generated by the Institute of Economy of the Universidad de Alicante in 2012 and is addressed at entrepreneurs. The platform is also offered as educational platform (a service) for universities, training centres, teachers and private companies for implementing online learning. The Universidad de Alicante, the Universidad de Murcia, some organizations and foundations, as well as training centres and private companies are partners of UniMOOC that offer MOOCs within the platform. Professionals and institutions could also offer Webinars, training itineraries (group of courses) and premium courses (closed and with a fee) through UniMOOC. In 2020 the platform stop working but the course contents were published [openly](#).

Institutional (O)ER repositories

As described in the introduction of the section Infrastructure, it is common that each university has its own institutional repository and, in addition, other spaces where specific kind of (O)ER are published; for instance, OCW, MOOCs or videos.

Some universities have institutional repositories where all or most of the (O)ER are grouped and centralized. For example, the institutional repository of the Universitat [Jaume I](#) based on Dspace 3.2 includes in its teaching materials' collection, OCW under CC BY-SA 3.0 license, MOOCs and other types of (O)ER. All these (O)ER are also indexed in MDX. The institutional repository of the [UPC](#), also based on DSpace, includes the OCW (<https://ocw.upc.edu/>), as well as other teaching materials (books, exams and videos), under CC-BY 3.0 license for the metadata. The institutional repository of the Universidad Internacional de Andalucía ([UNIA](#)), based on DSpace 6.3, now includes also the OCW collection under CC BY-NC-ND 4.0 license. Also based on DSpace, the Universitat de Lleida includes OCW in the teaching materials' collection of its institutional repository (<https://repositori.udl.cat>). A different case is the Universidad Politécnica de Valencia (UPV), which has an integrated platform (the VLE, [poliformaT](#)), based on Sakai, that includes the links to the other repositories (institutional repository based on documents, two different types of video repositories and two different types of repositories of online courses). The UC3M [Digital](#) is the portal of the UC3M where all the university's open education initiatives (OCW, MiriadaX, Khan Academy Zero Courses, Youtube Edu, iTunes U) are gathered.

Regarding specific repositories:

OCW repositories. Some universities keep their own OCW repositories (under CC by-nc-sa license), e.g.:

- Universidad de [Alicante](#): it was one of the ten foundational universities of the program in Spain and Ibero-America in 2007. In 2011, this university was named the first "Reference Site" by the OpenCourseWare Consortium due to its number of courses, variety of language and relevance of its contents. Since 2014 no new update is registered. The OCW-UA Office as part of the library services is in charge of the repository.
- Universidad de [Salamanca](#): it had an OCW regulation for the OCW USAL repository.
- Universidad de [Oviedo](#).

Other universities are still active in OCW and have some calls to support OCW creation (same license), e.g.:

- Universidad del País [Vasco](#): it presents annual calls for OCW development and update (still active), within the services of eCampus (virtual campus service).
- Universidad de [Cantabria](#): it has an annual call for the development of new OCW published by the Vice-Rectorate for Academic Planning and Teaching Staff with the support of the virtual campus unit and the centre of training in new technologies.
- Universidad [Carlos III](#): as in the other cases, there are annual calls for promoting the development of OCW by faculty. The OCW-UC3M Office as part of the library services oversees the repository and the call.

MOOCs. Although most of the universities involved in MOOCs use mainly MíriadaX, some universities have their own MOOCs platforms; for instance, the [UNED](#) and the [UPV](#), both using the Open EdX technology, or the Universidad de [Granada](#), with an own developed MOOC platform.

Video channels. For instance, the UNIR has its own [Youtube channel](#) with (O)ER and its restricted [TV UNIR](#) with video-cast resources, lectures, presentations and open classes. The UNIA has its own [Vimeo channel](#) on teaching innovation. Similarly, the UPV has an open video [platform](#), and another restricted platform for video-notes/lectures.

Other (O)ER virtual platforms. Some universities have an additional channel that use to publish (O)ER. For example, the Universidad de Murcia has its podcast channel in [ivoox](#) with both (O)ER and dissemination programs. The Universitat de Girona has a digital repository of audio and video based in [DSpace](#), that includes (O)ER.

Institutional repositories. To show an example of the co-existence of diverse virtual spaces for (O)ER, UNIR has also its own institutional repository [Re-UNIR](#), which includes learning materials and research outputs with CC 3.0 licenses, apart from the video channels previously mentioned. The Universitat de Girona has also an institutional repository for [documents](#), which includes (O)ER.

Concerning actors involved, the management of (O)ER is mainly done by the libraries (84.9%), along with the technological/IT services (32.1%). Other actors are the teachers (28.3%), the virtual campus services (22.6%) and the educational innovation units (18.9%). In most of the cases, the library works together with one or more of the other services (Santos-Hermosa et al., 2019).

According to Santos-Hermosa et al. (2019), the standard used predominantly is Dublin Core (86.8%) and there is lower presence of the enriched Dublin Core (1.9%) and LOM (11.3%), which allow further educational description. 92.5% use the OAI-MHP protocol for their interoperability. These data confirm the observation of the repositories analysed: when they have information on the interoperability protocol that they are using, they mention OAI-OMH.

3.4 Quality of OER

Mechanisms of (O)ER quality

In general, each university with services supporting the development of (O)ER has institutional quality assurance mechanisms/guidelines and guides to support instructors in that task. In some cases, these guidelines are derived from the instructions for getting funding for the creation and publication of (O)ER.

Examples include:

Institutional criteria or guidelines for creating (O)ER.

For instance, the Institute of Educational Sciences (Faculty Training Unit) and the Area of Information and Communication systems (IT) of the UPV have published a guide called "Learning objects as resource for university teaching: criteria for its [creation](#)". The guide includes the definition of (O)ER in the context of the UPV, the steps to produce them, recommendations to create different types of (O)ER (such as slides, videos and text documents), and a metadata sheet and an evaluation sheet. The metadata sheet is based on the LOMv.1.0 metadata structure, which includes as categories a general descriptive part and the reference to the educational use. The evaluation sheet considers the characteristics of the (O)ER, its objectives, its contents and its metadata. The criteria should be fulfilled

by the (O)ER created within the Online Teaching Plan funding scheme of the UPV, and the quality of the materials is supported by the provision of multiple documents and templates for the development of [\(O\)ER](#).

Another case is the Centre of Education and New Technologies (CENT) of the Universitat Jaume I, which has published two web guides for creating (O)ER, one for accessible (O)ER and another one for [MOOCs](#).

The UNIA has an OCW in its VLE Moodle for faculty members regarding the preparation of OpenCourses for the institutional [repository](#). UNIA instructors can find there the guidelines and templates related to the pedagogical guide for the content, rather than for the technical specifications.

The Review Committee of the UC3M developed a "[Guide for the OCW Pedagogical Model](#)" in order to help faculty members with the process of preparing materials and creating courses that would meet a suitable degree of quality (Méndez & Webster, 2015, p. 3). Furthermore, the guide includes the rubric with the evaluation criteria used by the Quality Group. Other provided guides by the OCW-UC3M are: a general guide for OCW authors, an editing guide of OCW courses for authors (for EduCommons, the platform of the OCW-UC3M), a guide for creating presentation videos, a powerpoint template for course materials, among other documents of interests for OCW [authors](#).

Quality assurance of institutional repositories.

Some of the open access policies include a mention to the quality control of the repository. For instance, the UPV mentions that the quality of the contents will be guaranteed through quality standards for different types of contents. The UOC, in its open access policy, is committed to ensuring the integrity of the data and metadata introduced by the authors, and preserving and maintaining the permanent access to the deposited documents in the repository. Another similar example is the Universidad de Extremadura, who states that "(the institutional repository) will follow the international criteria and the quality of its contents will be ensured through the establishment of standards. A plan for the digital presentation that follows the international guidelines that guarantee the permanent access to the deposited documents will be developed" (Universidad de Extremadura, 2013, p. 3). Some OCW university platforms, for instance the OCW of the Universidad de [Cantabria](#), mention that they review that the materials do not infringe third-party rights, that correct citations in the materials are added and correct licenses applied, before the materials are published.

Annual call for (O)ER funding.

In the case of the UJI, the annual call for MOOCs funding establishes that the authors are responsible for ensuring the academic quality of the materials, which in turn will be evaluated by the program commission. Another example is the Universidad del País Vasco in her call for OCW includes a guide for the creation of OCW within the university and the criteria for the evaluation of OCW courses. These criteria include consideration [of](#): the teaching guide of the course, the extension and coherence of the course, the materials included, the activities and self-assessment tests, accessibility of the materials, information to the reference to material sources, and respect of the intellectual property of the resources. Materials should be published under a CC-BY-NC-SA license and be accessible without restrictions (no registration or login needed) in the platform OCW-UPV/EHU based on Moodle.

Similarly, the Universidad de Alicante defines the criteria of the MOOCs and NOOCs to be created by the faculty [members](#): workload of 40 hours / 4-9 weeks (MOOCs) or 15-20 hours / 2-3 weeks (NOOCs), structure organised in modules, inclusion of resources (audiovisual, theoretical of support, and evaluation), incorporation of an introductory module, use of a communication channel, intellectual property (CC) and pedagogical quality (autonomous learning and diversity for presenting contents). Some of the commitments of the grant recipients are:

- To ensure a free participation in the course,
- The inclusion of the institutional identification, participating in the training activities for recipients (technical and methodological aspects, editing of audiovisual materials and functionalities of the technological platform),
- To publish the course materials in the institutional repository.
- To host the course, with free self-enrolment, in one of the following platforms: Moodle formación-UA (part of the institutional VLE), Google Course Builder-UA or MiríadaX. The participants are also allowed to host the course in other open internal or external platforms.

Peer review of (O)ER.

In the case of the UC3M, the quality assurance of OCWs includes a peer review assessment system (Méndez & Webster, 2015). A rubric for evaluating OCW courses with ten items (distribution of course contents, study materials, practice materials, self-assessment tests, self-learning format, bibliographic sources and information resources, accessibility of supplementary materials, adequacy of the pedagogical proposal, coherence of the proposal and clarity of the proposal) to be evaluated on a scale of 0 to 2, and in some cases 0 to 3, was developed (Méndez & Webster, 2015, pp. 8-9). For this process, faculty members that had already received an OCW award or mention were invited to be enlisted as reviewers and the institutional VLE Moodle was used to include the functionality of grading by rubric - instead of the UC3M-OCW based on the eduCommons platform (a Quality Assurance state is included but reviews based on the rubric were not possible). If the courses are not considered eligible for publication, the Review Committee proposes some recommendations to improve the materials.

We can also find quality assurance proposals based on autonomous communities' documents. For example, Rodríguez et al. (2013) present a proposal to evaluate MOOCs based on the Guide Afortic. This guide is a document developed by 8 out of 10 Andalusia universities (Working Group of the Virtual Andalusia Universities) in order to evaluate the quality of online programs in this autonomous community.

Institutional agents for (O)ER quality

Although university libraries have the major role in ensuring the quality of the institutional (O)ER infrastructures, especially the technical one (metadata, interoperability...), some other actors can also be mentioned.

As previously described, many universities have an annual call for promoting the creation of (O)ER by faculty members. This call usually counts with an evaluation commission, who evaluates the applications and, therefore, the quality of the proposed materials, and ensures criteria compliance during the funding period and (O)ER publication. For instance, in the case of the Universidad de Alicante, the evaluation commission of the annual call for the program PENSEM-ONLINE (program for blended and online learning training), which focuses on the creation of digital materials and online courses, includes the vice-rector of Educational Quality and Innovation, the vice-rector of Studies and Training, the director of the Institute of Educational Sciences (unit for faculty training), the director of the Quality Secretariat, the director of the Secretariat of Technological Resources, the director of the Further Education Centre, and the area of Support and Assistance to Users. In this same university, the participants in the call count with the Institute of Educational Sciences for the technological and pedagogical support for designing and developing the approved projects. This Institute also ensures the quality of the final product during its production. The Vice-rector of Campus and Technology (IT unit) collaborates in the guidance and support tasks for the use of the Moodle formación-UA and Google Course Builder-UA platforms.

The UC3M de Madrid of the OCW-UC3M project has a quality group for the project, whose objectives are to:

veil for the quality of the contents and the impact of the courses published on the UC3M-OCW site; determine the organizational criteria and the content structure to which the OCW courses have to adhere; and foster promotion of OCW courses and their relationship with the degree programs offered at UC3M. This group is composed of representatives of the following areas: graduate studies, postgraduate studies, quality issues, online education, OCW Office, and is coordinated by the Vice-Rector for Infrastructures and Environmental Affairs. The main tasks undertaken by this working group involve managing the annual call for proposals to be submitted by faculty to take part in the project, selecting the courses to be published on the OCW-UC3M site, overseeing the quality of the courses, and fostering faculty participation in the awards for excellence in OCW launched by the Open Education Consortium and Universia, the Spanish OCW consortium. [...] the OCW Office staff would be responsible for carrying out the formal technical review concerning aspects such as correct use of Creative Commons licenses, intellectual property rights, metadata, etc. [...] The Quality Group would undertake the review of the pedagogical aspects, for example the balance between the theoretical and practical content, the degree to which the course fosters self-learning, the clarity and coherence of the didactic proposal, etc. [...] A sub-committee was formed within

the Quality Group that is composed of the Vice Deans for Quality at the Faculties of Social Sciences and Law, and Humanities, Communication and Library Sciences, and the Assistant Director for Quality at the School of Engineering. This Review Committee, coordinated by the Deputy Vice-Rector, is responsible for implementing the validation process of new OCW courses to determine whether they meet sufficient quality criteria to be published on the OCW site. (Méndez & Webster, 2015, p. 2-3)

In the case of the Universidad del País Vasco, the evaluation of the OCW courses is done by three main actors: eCampus (the institutional digital teaching and learning unit) for the verification of compliance of the formal aspects, the corresponding Department for the scientific rigor of the proposal, and the University Commission of Teaching Evaluation for coherence, balance and clarity aspects.

4. Individual infrastructures for digital educational resources (micro level)

4.1 Questionnaire

The Spanish survey was designed ad hoc based on the four elements for the EduArc studies (Infrastructure, Quality, Policy and Change) related to the micro level, and was initially revised by three Spanish faculty members connected to the area of educational technology. All of them were experienced lecturers used to creating and working with OER; one of them was additionally an expert of survey design and validation. The survey was modified according to the suggested changes (e.g., clarification of some items in their formulation, revision of some scales, addition of some new subitem). The final version of the survey (in Spanish) can be found [here](#).

During the 3rd week of January 2020, the survey was administered online via the online platform system supported by the University of Oldenburg based on Limesurvey and was open until the 5th of March 2020. The invitation to the survey was disseminated through personal contacts and social networks (Twitter, Facebook, LinkedIn), and a request to disseminate the survey to academic staff was also sent to recognised Spanish university associations as G-9 and educational technology associations (EDUTEC and RUTE). In addition, this request was sent to study deans, so that they would disseminate the survey to their university faculty members. These diverse dissemination strategies were successful in covering in a comprehensive way the Spanish HE situation at the micro level (number of universities participating, disciplines, academic positions...). Also it was noticeable a high interest in the subject (O)ER on the part of specific individuals and groups. However, these strategies were also time-consuming and far beyond the coverage expected from the EduArc reports [\[8\]](#).

The survey had as objective to know the level of creation and use of (O)ER and their repositories of academic staff for teaching and learning. An explanation of what (O)ER were considered within the project was included. Information about the EduArc study and the information consent were included too.

The sections that formed part of the survey were:

- Basic data, such as the HE affiliation, academic position or field of knowledge.
- Use and creation of (O)ER: general aspects.
- Infrastructures of (O)ER.
- Quality of (O)ER and infrastructure.
- Measures of promotion for creating and using (O)ER and infrastructure.
- Policies and regulations on (O)ER and infrastructure.

Based on the national general data statistics on academic staff in the 2018/2019 academic year (120,383 for the total population), the representative sample size was calculated according to a 95% confidence level (N = 383).

Background data of the participants

The representative sample size was largely surpassed with 576 total answers obtained, from which 400 were full answers [\[9\]](#).

Out of the 576 academic staff that took part in the survey, 49.9% are female and 47.5% male (2.6% did not answer). Participating academic staff were affiliated to 64 universities (out of the 84 existing Spanish universities), though only 24 universities counted with at least 10 participating academic staff.

In terms of age, there were participants in each range without a clear majority. The lower percentage is located between 23 and 34 years old (9.7%). The other percentages are distributed as follows: 35-40 years old (13.6%), 41-46 years old (20.4%), 47-52 years old (22.2%), 53-58 years old (20%) and more than 59 years old (14.1%). Most the participants had more than 20 years of teaching experience (46%), and also more than 20 years of teaching seniority at their current institutions (36%). The 17.1% participants with between 1 and 3 years of teaching tenure at their current institution is to be highlighted as the second most common situation.

The most common academic positions of the participants were Adjunct Professor (nontenure, part-time) (20.4%) and Associate Professor (civil servant, tenured, full-time) (25.3%). The next most common academic rank is Associate Professor (not civil servant, tenured, full-time) (15.6%). Although all the disciplines were represented, most of the answers came from Social and Law Sciences (42%), followed far behind by Health Sciences (17.5%) and Engineering and Architecture (15.5%).

According to the academic position, 69.4% stated that they could decide on creating and reusing (O)ER, against the 23.6% that took decisions with other faculty members and 5.4% that could not take this decision because the (O)ER were given by the institution.

Use and creation of (O)ER

Almost half of the academic staff (45%) use mostly (O)ER that have Creative Commons licenses. From these Creative Commons licenses, most of them (60%) allow reusing (also commercially) and remixing.

The types of (O)ER that are most used are:

- Slide presentations (87.7%), (O)ER in text format (74.5%) and pictures (65.9%).
- Videos (48.4%) and assessment tests (43.3%) are in the second place.
- Other kinds of materials are used with less frequency (e.g., infographics) or even merely anecdotally (e.g., podcasts).

When asked about how they include (O)ER in their teaching, most of the participants stated that they use their institutional virtual learning platform, several use (O)ER in class without being incorporated in any virtual space (only used or provided in the face-to-face class) and few mention video spaces (and other virtual spaces). These results coincide with the meso level report done in the context of university OER in Spain (Santos-Hermosa et al., 2019).

Some of the quotations referring to those aspects are as follows:

"(O)ER are accessible through the institutional virtual platform. Some (O)ER are linked (e.g. doc drive, videos...), other are uploaded to the platform"

"I used the (O)ER in class and I incorporate them, as students do, in the Moodle platform"

"Generally, (O)ER without being incorporated in any digital space"

"I create my own videos to use in my classes, which are shared on Youtube"

"(I include (O)ER) in presence in the class, synchronously in distance learning, asynchronously through the university platform, in my Youtube channel and in my personal-professional blog"

Some of the academic staff mention the co-creation of (O)ER by their students. For example:

"(O)ER are shared with the students through the virtual classroom in Moodle (b-learning). Students also share the created (O)ER (trying that they use these CC licenses, whenever possible) in the same platform"

General information about the use and creation of (O)ER showed that it is a common practice for Spanish academic staff to use the institutional virtual learning platform to provide (O)ER to the students, many less participants mention open virtual spaces that would allow to share (O)ER beyond the classroom or the institution. On the other hand, the most used types of materials seem to be the ones that are associated to in-presence teaching situations.

OER Infrastructure

Concerning infrastructures, 64% of the participants stated that their university has one or more (O)ER repositories, but 27.4% were uncertain about this. In any case, most of the participants did not use the (O)ER that are in their institutional repositories (68%), did not publish their own (O)ER in them (50.6%) and do not search for (O)ER in the institutional repositories (48%). On the other hand, they did not publish their (O)ER somewhere else (68.6%) and, if they did, they do not use Creative Commons licenses (59%).

As given reasons not to use the institutional (O)ER repositories, the most relevant one is that academic staff did not find (O)ER useful for their teaching (43.7%). However, other items that had a high presence are the lack of support mechanisms to use them (25.6%), the lack of any compensation for their use (21.1%) and the concern about the management of the (O)ER author rights (21.1%). Many participants stated under "Other reasons" that they were not aware of the existence of this kind of institutional repository (for (O)ER) or that they did not investigate them.

When asked if the (O)ER repositories are connected to other institutional systems, such as the learning management system, the intranet, etc., 45.6% stated that this integration exists, but a high number of academic staff were unsure (34%). Participants were also rather uncertain about the involvement of other external institutions in the support or maintenance of the institutional (O)ER repositories (56.4%). According to 58.2% of the participants, (O)ER repositories are relevant for the institution in terms of visibility and reputation.

Academic staff used institutional repositories in different ways but being the common ones as a place to store (and share) (O)ER – referring, in most of the cases, although not explicitly, to the institutional virtual learning platform. Several mentioned using them for searching (O)ER. Some examples of quotations follow:

"(I use them) to share my teaching notes with the students"

"As a personalised repository of (O)ER for the students"

"To store all the class materials and activities"

"(I use them) when searching for useful contents for the students, basically highlighting the (O)ER that could be interesting for learning to the students"

"Search for information, show examples for students of assignments and resources"

Quality of (O)ER and infrastructure

In terms of quality of (O)ER, the participants valued the most the type of resource (text, video, audio, etc.) (55.1%), followed by the reputation of the author of the resource (50.8%) and its availability in the institutional repository (50.3%). Aspects such as the use of Creative Commons license, the inclusion of metadata, the adherence to international standards or the inclusion of some type of evaluation or comment about the quality of the resource were important for around 30% of the participants. Some of them mention the quality of the resource in terms of content and design as well as its pedagogical potential, for instance:

"Formal quality and content from the perspective of contributing to competences"

"Usefulness of the resource to achieve student's learning"

"A good pedagogical justification of what it consists of and what it could serve from an exclusively educational point of view, that is to say, of a potential increase in learning results"

"Coherence and graphic quality related to the course content"

"Relationship to immediate teaching"

"The rigour of its content"

On the other hand, most of the participants stated that they did not know how mechanisms or procedures for ensuring the quality of repositories and (O)ER in their university work. Several of them mentioned that there are no (O)ER repositories in their institutions. Only few academic staff mentioned some institutional services; for example, the vice rectorate of digital campus, the teaching department, the course manager/coordinator or the author (teacher/s), the technological or informatics unit, the unit of educational advising, or the library. Some quotations that reflect these statements are as follows:

"It is self-publication, there are no mechanisms of evaluation or quality in the repository. The OCW project died, it was not followed up"

"I'm not talking about the case of my university, but in general; at my university the only repositories (as far as I know) are for theses and dissertations, and some library material (texts), but not that kind of OER you ask for"

"I know that there is a protocol and recommendations, such as how to use the Creative Commons license, but it is neither easy nor priority task for academic staff that we are also researchers"

"It is revised by the team of the Vice-rectorate of Digital Campus and Transmedia"

"(These are) functions of the area of the Library"

"The technicians in charge of the repositories supervise their classification and labelling, but not the quality of the resource content. Only those resources developed with technical support of the unit are usually subject to greater quality controls - in terms of content"

According to the participants, the actors with more influence in their universities to define the quality of (O)ER, their metadata and their repositories were mostly the same academic staff members that use them (41.2%), followed by the library service (38.7%), the virtual campus unit (34.8%), the technological or informatics unit (34.6%) and the academic staff that share a same course (33.5%).

Measures of promotion for creating and using (O)ER and infrastructure

Concerning promotion of change, academic staff were asked about which measures were applied in their universities to support academic staff to create (O)ER and their metadata. Many participants stated either that they did not know if there were any or that they did not exist. Among the options given in the questionnaire, the top ranked was technical support (42.2%), followed by training support (39.3%). Other open answers related to this question were the following:

"In some cases, support has been offered for creating knowledge pills and for creating resources to incorporate in MOOCs. Some initiative is supported by the teaching innovation program of the university"

"More stability in the workplace"

"Teaching dedication"

"Not many incentives, but some contributions are paid"

"I think there are economic and non-economic incentives, but I am not sure"

"Emails to encourage us to do it"

"It is recognised in accreditations but not in the University"

"They are valued but in short: they are made by teaching vocation and teaching conviction. They are not compensated financially, and it is very time consuming. It only produces personal and teacher satisfaction; in no case economic satisfaction, at least not at present"

"Now knowledge transfer is going to be promoted through the six-research periods. No doubt the picture will change for the better in that respect. People will be encouraged to spread the word about what they do and to participate in teaching development projects with valuable or at least successful technological media"

A few participants refer to institutional measures within their institutions, for instance:

- Through specific calls or calls for teaching development projects.
- Annual calls to write course handbooks.
- Award of teaching innovation of the social council.
- Call or program to produce (O)ER.
- Professional development, training courses.
- Guides to use the virtual campus.
- Funding for educational projects.
- Technical support for audiovisual production.
- Specific calls for creating MOOCs and NOOCs.
- Teaching evaluation and professorship accreditation.
- To be included in the working contract.
- Part of the plans for professional development.
- Certificates that could be used to ask for salary complements (quality complements).
- Online orientation/guidance.
- Existence of a centre for digital resources.
- Reduction in assigned teaching credits (teaching workload).
- Teaching recognition/acknowledgments.
- Agreements with other national and international centres.

Among these answers, some participants made some important points that connect to institutional procedures, conditions and relationships:

"In my case, digital educational resources are a prerequisite for teaching and, therefore, the creation, use, adaptation, reference to those resources is done in order to be able to teach the courses. Publishing the resources in a common university repository is another matter. The resources are and remain in the virtual classroom for at least 3 years - in my case - and serve as a reference to other instructors who teach the same course. But I do not know, or I have not used, if there is a repository with all the digital educational resources of the university, [...] open and organised for all instructors. There are works and materials published in different sites online, but I do not know -may be- a reference repository where all the resources are together. If it exists, it lacks dissemination and coordination, which should be promoted so that we all contribute new resources there. But I emphasize the need to improve the working conditions of adjunct professors, since we already suffer from an excess of unpaid work. [...] If the contracts were more stable, if they were offered a growing opportunity for improvement, the committed adjunct professors could spend more time preparing and improving the educational resources they use and the university could accompany this process and demand that, but for that to happen, there's still a long way to go, unfortunately"

"My university's repository has only been functioning for a few years, it still lacks dissemination, awareness, human resources and time to consolidate itself as a tool for everyday use. That said, there is a big problem today with the availability of time for the work of the academic staff. There are more and more resources, more incentives, more quality, more management of all that, more teaching hours. The analysis of reality speaks for itself. Either more people are hired to carry out new sectors of activity, or this is going to collapse, especially since after the crisis, our universities have hired a large number of adjunct professors and positions for permanent full-time and civil servants' professors have been frozen"

"(These measures) do not work properly, since the spent time in the bureaucratic procedures do not redeem the elaboration and publication of (O)ER"

"Among my colleagues there is a divisor line: pragmatically (it does not count for the accreditation) and idealists (it is ethically important)".

"At my university they hardly care about this. And certainly, NOBODY gets any support."

"It is not actively promoted. It must be the faculty member's initiative and the only technical support offered is extremely limited in its conditions (there is only technical support to produce very short videos with a standard format similar to a class with slides). And there is no institutional resource repository, so it is impossible to know about other instructors' resources or to disseminate one's own"

"The University has a specific unit for the creation of digital educational resources, which works pretty well. It makes annual calls, and offers technologies for its production, as well as a series of annual courses. It takes into account the participation as a teaching merit, but not enough. And sometimes, it's a bit rigid: probably, due to the lack of staff, although their involvement is total. About teaching repositories, they have very little visibility in general, and its reuse is not encouraged: there is a general policy of helping to create your materials, but not to share them (it is more a particular initiative of academic staff, in this regard)"

Policies and regulations on (O)ER and infrastructure

Only 21.7% of the participants stated that there is an institutional explicit policy or regulations concerning the use and/or creation of (O)ER in their universities. Most of the participants were uncertain about this (61.7%). Slightly some more participants stated that there is an institutional implicit policy (23.7%) – against a majority that did not know (60.5%). Similarly, most of the academic staff (67.4%) were unsure about the existence of institutional policies connected to specific study programs or to departments/faculties. Only 14.8% were positive about this existence.

Most of the instructors were either not involved in the preparation of these institutional policies (36.3%) or uncertain about it (54.6%). Therefore, it could be considered that institutional policies with this regard, when exist, are mainly top-down in most of the Spanish universities, at least from the point of view of the academic staff. When participants were asked about academic staff being able to influence somehow those policies, 26.2% stated that they cannot influence explicit policies (a smaller percentage than lack of involvement in the preparation of the institutional policies) and more than before were unsure about it (57.8%).

Some quotations regarding this aspect are as follows:

"It is possible that institutional policies exist, but they are not applied, or they are not presented to the university community, or it is not an element that goes beyond the tasks of adjunct faculty"

"In my university there is a total lack of regulations and suitability for online teaching, which forces academic staff to self-manage and depend on their own knowledge and willingness so that the courses work properly"

"My opinion is that my university's digital resource repository policy is not systematic and clear. The creation and use of the resources (typically not open) mainly depend on the academic staff. The typical use of the resources is in the virtual campus courses. There is support for the creation of MOOCs. There is an institutional repository for the repository of student products (final degree project, master thesis, doctoral theses) and research products. There is a policy of support for teaching innovation, which sometimes refers to projects related to teaching resources"

"We receive documentation on privacy policies and use of the different resources that the university provides and then we do a compulsory test to check that we have read and assimilated the documentation"

"There is a secretariat of audiovisual resources that establishes the policy of the call"

"The distance between the rectorate and the faculties and departments is immense, even physically, and the bureaucracy is huge"

"There is a policy, but it will have to be improved and more widely disseminated. I do not believe that there is a lack of interest, on the contrary, but there is a lack of time and of more measures in the direction taken so that it becomes part of the culture of the institution. Among these measures are all those that facilitate and make it possible to use it among that part of the academic staff interested: time, space, incentives, recognition..."

No additional institutional policies or regulations were identified in the open answers, apart from the ones mentioned in the meso level. As was described above, most of the participants did not have knowledge about having this kind of policy.

Additional post-Covid-19 survey

Considering the educational emergency situation, some changes may have happened in the scenario described before. A new survey was delivered to the participants in the previous questionnaire that wanted to keep in contact regarding this study.

The structure of the questionnaire included a short version of the previous one with some reformulation related to the changes in their institutions and their individual use of creation of (O)ER related to infrastructure, quality, policy and change.

Out of the 150 faculty members that were invited to participate, only 46 submitted their answers (50% males and 50% females). Age ranges most frequent were 41-46 years old and 47-52 years old; in total: 47.8%. 43.5% of the participants had more than 20 years of teaching experience. Most frequent academic positions were Adjunct Professor (28.3%), Associate Professor (not civil servant, 21.7%), Associate Professor (civil servant, 17.4%) and Assistant Professor (13%). Disciplines most represented were Social Sciences and Law (41.3%), Engineering and Architecture (21.4%) and Arts and Humanities (17.4%).

Among the types of (O)ER that were offered as options in the original questionnaire, online questionnaires (68.9%) and videos (62.2%) were the ones with a higher increase of use/creation during Covid-19; to a lesser extent, the use of teaching text-based materials (instructions, class notes, activity guides) also experienced an increase (51.1%). The other types of (O)ER were used in general with the same frequency than before Covid-19.

Regarding the use of (O)ER platforms, most of the participants used the institutional virtual platform (usually Moodle) to support their teaching and include their (O)ER, which some of them were already using before. Some universities obtained MSTeams licenses or used more intensively the institutional video repository for teaching. Google Drive is mentioned by several faculty members. Tools mentioned by one or two faculty members in each case are Kahoot, Padlet, Socrative, Edmodo, Google Classroom, infographics and mind maps. A faculty member mentioned Youtube and

Vimeo to upload their own videos with restricted access for students. Another participant mentioned their own webpages to share their own (O)ER. A third participant mentioned Kaltura to record videos.

Although most of the participants state that the changes have been mostly quantitative instead of qualitative:

- A faculty member mentioned that in their institution there are now incentives for shared creation and use of (O)ER.
- Another participant stated that faculty members' awareness of the importance of uploading the used/created (O)ER in the institutional websites has increased. The fact that the (O)ER transparency, sharing (O)ER (and use of internal repositories), has been improved is mentioned by several faculty members.
- A third participant mentioned that they take advantage more often from the faculty professional development offer, and that to create (O)ER they needed pedagogical and technical support. The increase of (O)ER use and creation's competence by faculty members and the relevance of online training was mentioned by others too (not about sharing or the evaluation of (O)ER quality). A participation mentioned the institutional use of peer mentoring.
- A participant mentioned that their university has included as new elements for the (O)ER quality: short, clear, multiplatform, use of simple formats (inclusion). Another mentioned the work towards (O)ER quality of the pedagogical and technological support unit; some others mentioned a collaborative work between faculty members with this respect.

Most of the faculty members stated that there were no new (O)ER policies. In the cases where new regulations (or modifications of these ones) existed were mostly connected to data protection and copyright issues.

The results of these second questionnaire revealed an intensive institutional work (meso level) in terms of pedagogical and technological support and professional development training for digital teaching and use/creation of (O)ER, but mostly not specific new (O)ER policies.

At the macro level, new national initiatives appeared in order to create a community of exchange of online teaching and learning experiences and (O)ER:

- [La universidad en casa](#) (The university at home): originated by CRUE with the close collaboration of open universities such as UNED and the UOC
- Facultad cero ([Faculty Zero](#))
- Collection teach and learn from home ([EDULLAB](#))

Literature review

To supplement the answers from the survey, desk research connected to literature review was conducted. The literature is described and divided according to the different aspects investigated (infrastructure, quality, change), including non-exhaustive examples. Some of them come from the open answers at the end of the questionnaire where it was asked if the participants knew some OER infrastructures to share.

However, being policy rather an institutional aspect, no work was identified within that topic and, therefore, no section for policy is included. In the case of OER infrastructures, the connections with the institutional level are clear, and sometimes difficult to completely separate from the micro level.

4.2 OER Infrastructure

The UOC has developed an infrastructure related to teaching materials called NIU that consists of a curated content aggregator linked to the activities (Figure 1). In its mosaic-like structure, NIU lets students see what activity needs to be completed and the learning resources (UOC-created content, external resources and guidelines) provided to help them do [so](#). No indications are provided about how these resources are shared in NIU.



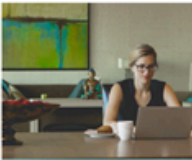

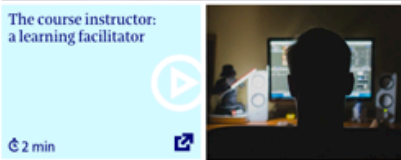

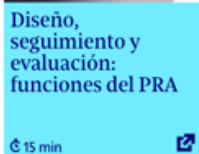

Figure 1

Example of an NIU. [Source](#).

What are my responsibilities as a coordinating professor?

2 h 8 minutes minimum of reading and comprehension time



 <p>Who mentors the student in the learning process and how is it done?</p> <p>⌚ 5 min</p>	 <p>Dedicating time to design is investing in better learning</p> <p>⌚ 3 min</p>	 <p>The design of an online course in seven stages</p> <p>⌚ 50 min</p>
 <p>The course instructor: a learning facilitator</p> <p>⌚ 2 min</p>	 <p>What is a UOC classroom like?</p> <p>⌚ 20 min</p>	 <p>The classroom blog: comprehensive information on classroom resources and tools</p> <p>⌚ 30 min</p>
 <p>Diseño, seguimiento y evaluación: funciones del PRA</p> <p>⌚ 15 min</p>	 <p>A constructive approach to the design of educational actions</p> <p>⌚ 3 min</p>	

Cacheiro-González and Rodrigo San Juan (2016) described an experience of creating audiovisual (O)ER by faculty staff and tutors at the UNED through an audiovisual platform that allows synchronous access to face-to-face video-classes with remote interaction with the participants. The instructors' recordings are classified according to different criteria (author, title, etc.) and are autonomously managed by the creators through a platform. Examples of videos created by instructors and tutors with this platform answer to different use scenarios according to the specific educational objectives: presentation of the general orientations of a course, orientation for the development of formative assessment activities, invitation to experts related to the topic of the training programmes.

Maina and Guàrdia (2013) described the process of developing an OER for a Master course in Education and ICT at the UOC by two faculty members within the role of experts in the discipline and responsible for teaching the course. The following tool functionalities for developing the OER were identified (an extended wiki):

- Content presentation (all the formats),
- Personalisation / accessibility (ensure universal access),
- Productivity (support individual and collaborative work),
- Social appreciation (allow students to express opinion),
- Exchange (offer possibilities to share),
- Monitoring (ease ways of getting information about content modifications),
- Portability (provide options for consultation and access), and
- Roles and privileges (allow giving permissions for reading and/or editing each segment of the OER).

Concerning the UOC's institutional repository, Santos-Hermosa (2019) noted that the repository recently includes four collections of continuous assessment activities, due to a pilot test run with the Faculty of Economics and Business with the support of the UOC Library. In this collaboration, the academic staff took the role of creators and pioneers in publishing this kind of resource, and librarians were responsible for assigning metadata and depositing them in the repository. These OER are available in open access and in two languages.

Martínez and Ramírez Sádaba (2013) stated that good results in terms of number of visits to the OCW of the University of Cantabria was due to the correct categorisation of contents through the metadata manager of the EduCommons platform. Each content that is uploaded to the platform is given metadata by the support unit of virtual teaching. Metadata included are name of the document, teacher, date, keywords, license and link to the used license. On the other hand, OER within the OCW are easy to find and use, since it is possible to search by discipline, study program, publication year, etc.

Different studies have addressed the MOOC infrastructures in different universities from the perspective of the designers and the administrators.

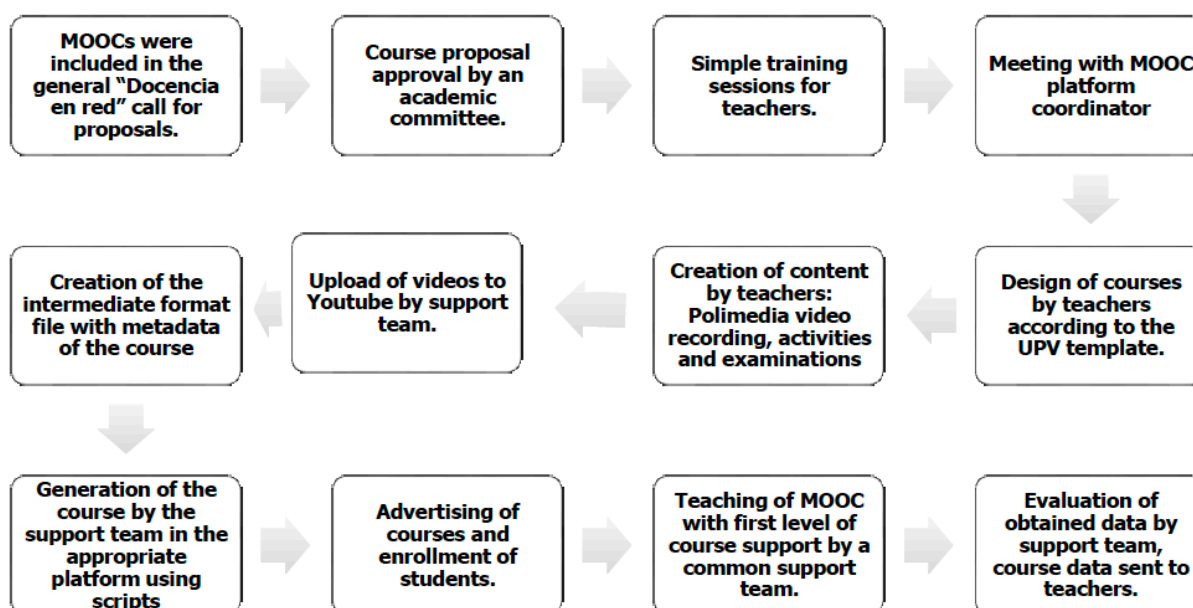
For example, Prendes Espinosa and Sánchez Vera (2014) presented their experience at the University of Murcia related to the design and production of four MOOCs taught through MiriadaX, funded by Universia in its first edition. The project was coordinated by the Unit of Innovation (Vice-rector of Studies) in collaboration with ATICA (Vice-rector of Economy and Infrastructures). The courses had more than 3000 registered students. The tools used in the MOOCs were: FAQ, forum, blog, wiki and Twitter (external tool). The evaluation of the MOOCs was done through an initial questionnaire, observation sheets and a final questionnaire. Students included as a way of improvement the promotion of interaction and community building, and not only individual work with the content. However, the use of the tools showed that students were more interested in the contents than in the interaction. Polemic was the certificate issuing, which was not possible at the end, due to the undefinition in the initiative MiriadaX. Over 10% of students finished the MOOCs, which made the MOOC experience a successful one.

Despujol et al. (2018) described the MOOC experience at the Polytechnic University of Valencia (UPV) from the technical and administrative points of view. This university was the European institution with more MOOC course runs done by December 2016. UPV currently has its own platform (upvx.es) based on openedX and is a member of edx.org, with 50 courses, 177 editions (by the date of the publication); before it was built on Google Course Builder and MiriadaX. The paper describes the institutional implementation during a period time of 5 complete academic periods (2012-2016). As a background it has to be considered that "UPV developed Polimedia, a system to record HD video learning objects using cheap audiovisual studios in a fast and straightforward way; as well as the program "Docencia en Red" that encourages and supports teachers that develop digital learning content and systematically assess its quality" (Despujol et al., 2018, p. 217). The general protocol of selection and implementation of MOOC at UPV is included in Figure 2.

The authors stated that the model is not self-sustainable for the University: the costs for verified certificates only cover the staff costs of the platform managers.

Figure 2

General Protocol of Selection & Implementation of MOOC at UPV (Despujol et al., 2018, p. 222).



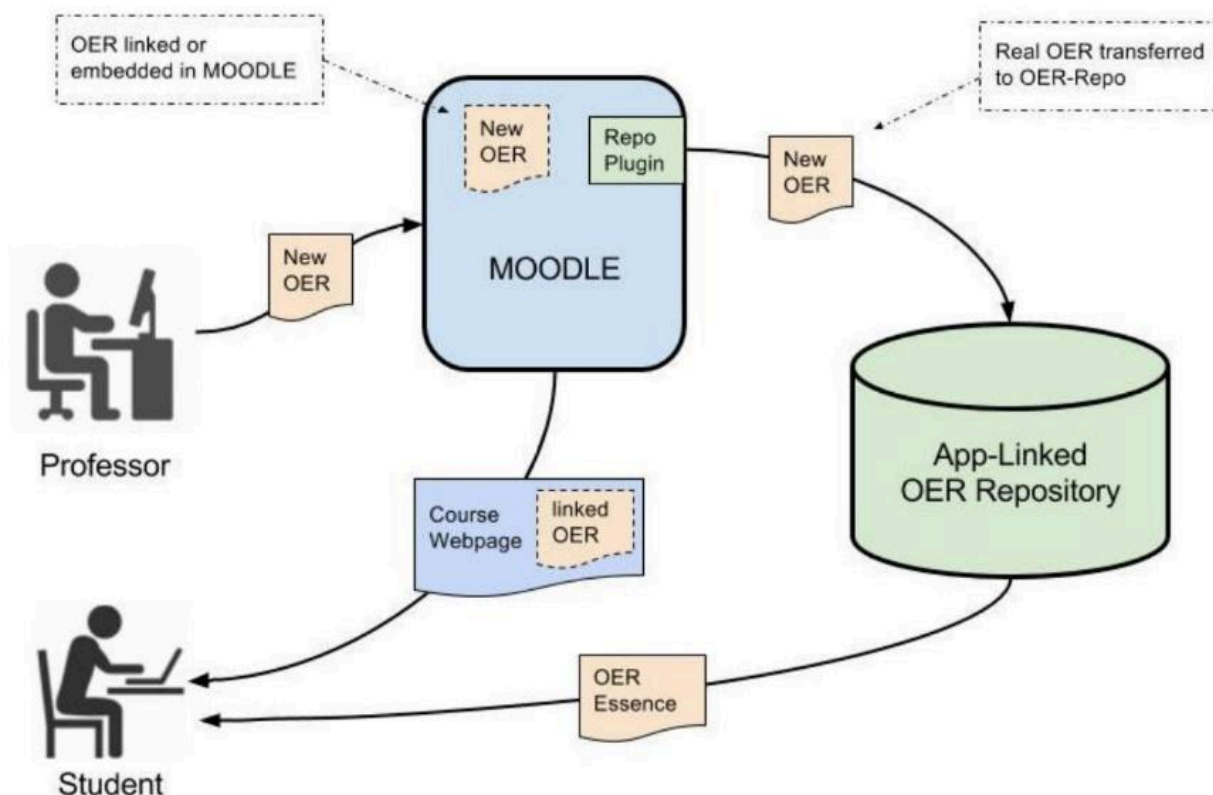
Fidalgo Blanco, Sein-Echaluce Lacleta, Borrás Gené and García Peñalvo (2014) presented the development and evaluation of the implementation of a MOOC with open software developed by the Polytechnic University of Madrid. The course was optional and part of a collaboration project between the Polytechnic University of Madrid and the Autonomous University of Barcelona. The OER of the course included instructor's videos, collaborator's videos, a wiki populated with OER by the participants, and a social network on LinkedIn. The results from the student questionnaire showed that it is possible to integrate the academic training with a MOOC model, and a high positive perception of students about the MOOC and its resources was reached. Students participated in an active way in the learning community of the MOOC.

Morales et al. (2017, 2016) presented the design of a MOOC in the area of toxicology (pharmacy) at the University of Salamanca as part of a teaching development project, although with participation from European countries (implementation under the Erasmus+ program). The Spanish university was in charge of the development of two courses within that MOOC to be offered in MiriadaX. The materials included a presentation video, videos of specific topics, formative tests, a final test, supplementary texts and bibliography. The evaluation of the course by Salamanca university students was positive in terms of considering the use of a MOOC an innovative tool and in terms of usefulness for their own self-learning. Furthermore, and overall, the course promoted students' interest in the concrete aspects that were explained, and students appreciated the quality of the material and appealing and easy to use platform.

Despite being in the context of high school (students moving towards university), within the frame of the EU project Up2U [\[10\]](#), in which the University of Vigo was involved as the main actor in OER, an application-linked repository was designed to suggest a central repository playing the role of a central hub for curation (Otero et al., 2018) (Figure 3). This could be an interesting contribution within the frame of the EduArc project since the approach may be valid for any other OER initiative beyond the context in which Up2U takes place.

Figure 3

Application-Linked Repository workflow (project Up2U) (Otero et al., 2018).



4.3 Quality of OER

In the UNED experience described by Cacheiro-González and Rodrigo (2016), use indicators of the audiovisual repository (statistics) were, at least in part, the measure of quality for the infrastructure. These indicators include, e.g.:

- Number of users
- Number of visits to the video repository
- Number of different academic staff that record videos
- Evaluation of the audiovisual platform
- Number of videos in the audiovisual platform
- Number of open videos
- Number of staff trained in the audiovisual platform
- Evaluation of the online conference

According to the evaluations, the usability of the platform is very high and 92% of the tutors that repeat the use experience with the audiovisual platform manage to do a session without incidences. Most of the academic staff and tutors (aprox. 8,000 usual users) create and maintain the virtual sessions in an autonomous way.

Related to the OCW at the University of Cantabria, another reason for the positive results in terms of number of visits to their OCW was related to quality (Martínez & Ramírez Sádaba, 2013). Before uploading any OER, these resources must undergo a quality control. First, the support unit for virtual teaching talks with the academic staff to know their expectations about the course, while at the same time they receive an explanation about the characteristics of OCW and can pose any question they may have. After deciding the best way to publish the course (format), the support unit starts working with the OER, giving it homogeneity and improving all that can be improved. At the same time, the support unit deletes texts and pictures that could have problems of intellectual property and replaces them with alternative resources with copyleft. If the support unit does not find an alternative, it would be created in the

department. This is possible thanks to the existence of an OCW Department, formed by an OCW coordinator, a graphic designer, a multimedia programmer and a technical manager of platforms.

4.4 OER Change

Examples of change at this level are the initiatives of academic staff when designing, developing, implementing and evaluating teaching development projects in specific disciplines.

For example, the teaching development project based on a video series called *Arqueoudima* at the Distance University of Madrid (UDIMA, private open university) developed since 2014 (Casado Rigalt, 2018). It is an OER open to university students and professionals in the field (Archaeology) and includes two different video formats: video-lesson and video-interview. The project was born from the enthusiasm and confidence of a faculty member that knowledge should be shared and disseminated. In this line, the author conducted a questionnaire with HE instructors of Spain and from abroad (104 answers were from Spanish instructors) and showed that the acceptance of the audiovisual format by HE instructors is a slow and discontinuous process that is different in each discipline, despite general acceptance by university students. Many of the faculty members showed still scepticism towards the video as teaching resource, seeing it as a technological threat. The author remarked that fortunately the reception by academics of the use of audiovisual formats was increasingly improving.

A second example is the teaching development project based on the development and student use of multimedia resources (videos, tests, practical exercises, case studies, blogs, further readings...) at the Accounting Department from the School of Economics and Business Administration of the Complutense University of Madrid (Miñano et al., 2016). These (O)ER were included in the institutional virtual platform based on Moodle. Similar to the previous case, university students appreciated the multimedia materials as being very useful and motivating albeit complex.

In some cases, support units are key for change at universities. This is the case of the support unit of virtual teaching of the University of Cantabria (Martínez & Ramírez Sádaba, 2013), where the presence of this unit for teaching support in developing and sharing OCW is high. Each year the unit sends to each faculty member the results of the number of visits to their courses and delivers them a certificate of educational innovation, in which it is specified the origin and number of received visits. The instructor questionnaire about the satisfaction with their participation in OCW experiences showed a positive appreciation. 81% of the instructors received help and advice from the department, which was positively considered, and more than 60% stated that their OER improved after going through the department. 70% considered positive the remuneration associated to the publication in OCW. More than 70% said that they used OCW at class and online teaching at least occasionally, 12% always. Furthermore, 90% considered positively that universities publish OER.

5. Conclusion

While digitalisation at Spanish universities was advanced and the Covid-19 situation accelerated even more the digitalisation processes, it is still to be seen if those changes involve a real digital transformation in the future beyond individual practices and open access research, especially in the context of (O)ER infrastructures. Micro, meso and macro levels are clearly connected to each other's and need to be taken in consideration as a whole. A brief summary of these connections is described as follows.

Macro level data on the use and creation of (O)ER and repositories showed that libraries are the most relevant agents in terms of (O)ER infrastructures at the Spanish universities, and the duplicity of (O)ER in different repositories is a common factor. Although infrastructure is much more developed at the macro and meso level for research purposes, (O)ER have also its place – in some universities, even exclusive institutional repositories. Nevertheless, at the micro level, academic staff uses most often the institutional virtual learning platform to provide students with (O)ER – and these are usually not integrated with other systems in a way that share information -; fewer other systems that could involve sharing in the open.

In terms of (O)ER labelling, Spanish universities adhere to international standards and use standardised metadata for educational resources. However, academic staff (micro level) considers this important to a lesser extent, compared to the availability (and findability) of resources with content quality and suitable to their needs concerning discipline/field of knowledge.

Change is happening at the micro level mostly bottom-up, starting from enthusiastic and devoted academic staff, sometimes with economic and/or technical support from different institutional units (virtual campus, educational innovation, IT...), often linked to institutional calls for the creation of (O)ER. There are almost no measures in place beyond technical support and professional development training (meso level). On the other hand, when existing, policies are mostly top-down, largely with academic staff not being involved in the processes or even not being aware of them. This was reflected partially by the meso level results, where some of the highlighted policies included the co-participation of the educational community. Furthermore, an institutional situation in the Spanish university context that should be considered (meso level) is the high presence of adjunct professors, who are non-permanent, non-tenured instructors with a considerable workload and precarious work conditions. This issue seems important to highlight since it negatively affects the development and use of (O)ER at the micro level, in terms of limited time to devote to it (high teaching workload) and of lack of incentives to do it (no access to possible economic compensations in case they exist) – issue that was reflected in some of the questionnaire's answers.

As a concluding remark, the most prominent or unique aspects of the infrastructure for the dissemination of (O)ER in HE in Spain should be highlighted. These are the common use of institutional virtual learning platforms by academic staff (although usually not for sharing openly), the existence of institutional (O)ER repositories in some universities (in few more than one, with different type of (O)ER) and the management led by the university libraries concerning metadata and infrastructure for (O)ER. The landscape described in this book chapter shows potential for the development, improvement and promotion of (O)ER infrastructures in the Spanish HE, but there is a strong need for further macro and meso level measures (e.g., institutional strategies and policies, rewarding measures, support and training) to make this potential effective.

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[1] The study was conducted when the author was affiliated to the University of Oldenburg.

[2] Official minutes of the CIC, 22 June 2009. https://crai.ub.edu/sites/default/files/recerca/politiques/mandataccesobert100701_0_1.pdf

[3] Updated data on OER policies can be found in the following article which was published after the present work: Santos-Hermosa, G., Estupiny, E., Nonó-Rius, B., París-Folch, L., Prats-Prat, J. (2020). Open educational resources (OER) in the Spanish universities. Profesional de la información, 29(6), e290637. <https://doi.org/10.3145/epi.2020.nov.37>

[4] Orden de 9 de marzo de 2005, por la que se convocan ayudas a proyectos para la elaboración de materiales y recursos educativos digitales en software libre, y se establece su procedimiento de concesión (Boletín Oficial de la Junta de Andalucía, 31/03/05).

[5] Link to the call is not accessible anymore.

[6] It should be acknowledged that changes in institutional infrastructures are likely to have happened, specially considering the Covid-19 situation.

[7] By the time of writing this report.

[8] Considering the high interest in the study results, selected results of this survey study were disseminated among the Spanish university community. If interested, please check (in Spanish):

- Marín, V. I. (2020). Uso de recursos educativos digitales y repositorios para la docencia universitaria española. En Colomo-Magaña, E., Sánchez-Rivas, E., Ruiz-Palmero, J. y Sánchez-Rodríguez, J., (Coords.), La tecnología como eje del cambio metodológico (pp. 975-978). Universidad de Málaga. (Libro de actas de Congreso EDUTEC 2020)

- Marín, V. I. (2021). Perspectivas del profesorado universitario español sobre el uso de recursos educativos digitales y repositorios de docencia. En J. Ruiz-Palmero, E. Sánchez-Rivas, E. Colomo-Magaña y J. Sánchez-Rodríguez (coords.), Innovación e investigación con tecnología educativa (pp. 175-187). Octaedro. (Versión extendida de la contribución al Congreso EDUTEC 2020)

[9] Acknowledgement: I want to specially thank all the faculty members that participated in the questionnaire and also to the study deans of the different faculties and universities that made this possible.

[10] <https://up2university.eu/>



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