# MOOCS AS A DISRUPTIVE INNOVATION TO DEVELOP DIGITAL COMPETENCE TEACHING: A MICROMASTERS PROGRAM EDX EXPERIENCE

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## Abstract

In today's economy and workforce digital competence is critical. Teachers are expected to have digital confidence and the necessary training to do a correct integration of technology in their teaching fields. This paper tells the experience of developing a MicroMasters program launched in edX platform. MicroMasters Programs are a series of graduate level courses from top universities designed to provide deep learning in a specific career field and are recognized by employers for their real job relevance Lapal (2017). "MicroMasters Program eLearning: Crea Actividades y contenidos para la enseñanza virtual" is a series of 4 courses developed by Universidad Galileo, the aim of this program is to improve teachers' digital competence. All MOOCs were designed in a collaborative and pedagogical approach by creating practical units that allow teachers learn specific cloud based tools (CBTs), design their own learning activities and learn how to incorporate them in different contexts. MOOCs are having impact at a global scale on teaching and learning, their potential to provide access to education, flexibility, versatile and capacity to promote innovation, make of them a good strategy to develop and improve teachers' digital competence in all areas.

### *Abstract in Spanish*

En la economía y fuerza laboral actual, el desarrollo de la competencia digital se ha convertido en un aspecto esencial para lograr la empleabilidad e inclusión social de todas las personas. Bajo este contexto y considerando que los docentes son un factor clave en la formación de los futuros profesionales, se requiere que estos adquieran y desarrollen la competencia digital necesaria para una correcta integración de las tecnologías de comunicación e información en sus áreas de enseñanza. Este artículo describe la experiencia de diseñar un programa virtual llamado MicroMasters, implementado en la plataforma edX, que promueve el desarrollo de la competencia digital en los docentes. Los programas MicroMasters son una serie de cursos virtuales a nivel y calidad de un postgrado, que han sido creados por prestigiosas universidades, para proporcionar un aprendizaje profundo en un campo profesional específico. Estos cursos son reconocidos por empleadores debido a su relevancia y aplicación en áreas laborales específicas Lapal (2017). El "MicroMasters Program eLearning: Crea Actividades y contenidos para la enseñanza virtual" está integrado por cuatro cursos: (a) Aprendizaje y Enseñanza Virtual, (b) Tecnologías Web Emergentes para la Enseñanza Virtual, (c) Diseño y Desarrollo de Recursos Multimedia para la Enseñanza Virtual y (d) Proyecto Final MicroMasters: e-Learning, los cuales fueron diseñados por Universidad Galileo, con el objetivo de desarrollar la competencia digital que todo docente del siglo XXI debe de tener. Los cuatro MOOCs se diseñaron con un enfoque colaborativo y pedagógico mediante la creación de unidades prácticas de estudio que permiten a los docentes aprender a utilizar herramientas específicas basadas en la nube (CBT), diseñar sus propias actividades de aprendizaje y aprender a incorporarlas en diferentes contextos educativos. Los MOOCs están teniendo un impacto significativo a nivel mundial en los procesos de enseñanza – aprendizaje, su potencial para proporcionar acceso a la educación, flexibilidad, versatilidad y capacidad para promover

la innovación, hacen de ellos una buena estrategia para desarrollar y mejorar las competencias digitales de los docentes en todas las áreas de su interés.

**Keywords**: MOOCs, digital competence, MicroMasters Program, teachers training, virtual education, CBTs, Cloud based tools

## Introduction

Information and communication technologies (ICTs) are changing the landscape of today's economy and workforce, the development of teachers' and students' digital competence has become a critical factor, to integrate them meaningfully in this new and changing society ruled by technology. The integration of digital competence into curricula should be a priority to address modern society demands Seufert (2017). Students need a variety of cognitive skills (problem solving, communicating, transacting, handling information and content and safe) to demonstrate they can efficiently use them to solve problems in digital environments Tech Partnership and Lloyds Banking Group (2018). This competence and skills must be introduced to them by teachers; institutions need to ensure that teachers have the necessary training to do a correct integration of technology in their teaching fields since they are responsible to guide students in their learning path to achieve this digital competence.

Teachers professional development is one of the key aspects of digital education, and MOOCs (Massive Open Online Courses) are a good strategy to develop and improve teachers' digital competence in all areas (specifically in areas such as professional engagement, digital resources, teaching and learning, assessment and empowering learners). This paper tells the experience of developing a MicroMasters program launched in edX platform. MicroMasters Programs are a series of graduate level courses from top universities designed to provide deep learning in a specific career field and are recognized by employers for their real job relevance Lapal (2017). "MicroMasters Program eLearning: Crea Actividades y contenidos para la enseñanza virtual" is a series of 4 courses developed by Universidad Galileo, the aim of this program is to improve teachers' digital competence.

The development, implementation, and running of this MicroMasters program involved several challenges. It had to address not only knowledge and skills, but also attitudes toward technology, social inclusion, and dissemination of knowledge. Another key element, to ensure the successful of the learning experience was to encourage the construction of learning communities, in which an exchange of knowledge and information was possible and permanent. All MOOCs were designed in a collaborative and pedagogical approach by creating practical units that allow teachers learn specific cloud based tools, design their own learning activities and learn how to incorporate them in different contexts.

Cloud based tools activities enhanced learning experience and allow teachers to develop digital skills, this type of activities recreates learning situations which require from them high-level of thinking, handling information, content, problem solving and collaboration strategies (generic skills). They allow teachers to assess performance, understand the process to design educational resources, share results with peers and tutors, learn and get feedback from them.

## Theoretical Framework

Digital technology is changing constantly Lamey (2018) and modifying the form people live, acquire knowledge and performance their jobs Brynjolfsson (2017), due to this European Commission (2018) has updated the definition of digital competence "Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), and problem solving".

There are many different terms and definitions but it can be broadly defined as “Digital Competence is the set of knowledge, skills, attitudes, abilities, strategies, and awareness that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, and socializing.” Ferrari (2012). Nowadays, our society is transformed due to the continuous development of technology, it’s evident how ICT’s have transformed today’s workforce requirements, students need to be trained with the necessary digital skills to solve problems in digital environments, they also need to have the right attitude towards ICTs and confidence to function in a twenty-first century society Alviram and Eshet-Alkalai (2006).

This reality has brought the need to develop teachers’ digital competence. Society needs competent teachers who can integrate ICT in their methods and teaching practices to keep up with the rapid changes of this new knowledge society (Krumsvik, 2014; Mishra & Koehler, 2006). Due to the impact of ICT in the modern society and workforce, educative institutions are also under increasing pressure to address the implications of all this in education and training fields. It is reflected in educational reforms, policies, and frameworks. (European Commission, 2007; Ferrari, 2012; 2013). Currently, common teaching practices are not enough, teachers need to try out new forms of teaching, but it doesn’t depend only on the technical prerequisite, it also depends on the skills and the willingness they have. The main challenge for teachers is how to improve students’ ability and confidence to develop digital competence.

European Commission created a framework to develop and reinforce digital competence in teachers, it is titled European Framework for the Digital Competence of Educators DigCompEdu. “The DigCompEdu framework is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational education and training, special needs education, and non-formal learning contexts. It aims to provide a general reference frame for developers of Digital Competence models, i.e. Member States, regional governments, relevant national and regional agencies, educational organizations themselves, and public or private professional training providers.” Redecker (2018). This framework is integrated by 6 areas and divided in 22 competences taking in count teachers professional and pedagogic competences and learners competences. (a) Professional engagement (organizational communication, professional collaboration, reflective practice and digital CPD); (b) Digital resources (selecting, creating and modifying, managing, protecting and sharing); (c) Teaching and learning (teaching, guidance, collaborative learning and self-regulated learning); (d) Assessment (Assessment strategies, analysing evidence and feedback and planning); (e) Empowering learners (accessibility and inclusion, differentiation and personalization and actively engaging learners); (f) Facilitating learners’ digital competence (information and media literacy, communication, content creation, responsible use and problem solving) Redecker (2018).

On the other hand, content, pedagogy and technology are the main components to have a good integration of teaching with ICTs and the interaction of these three components in different scenarios generate quality in technology integration in the teaching field. TPACK (Technology, pedagogy and content knowledge) framework was created for this purpose, Koehler and Mishra (2009).

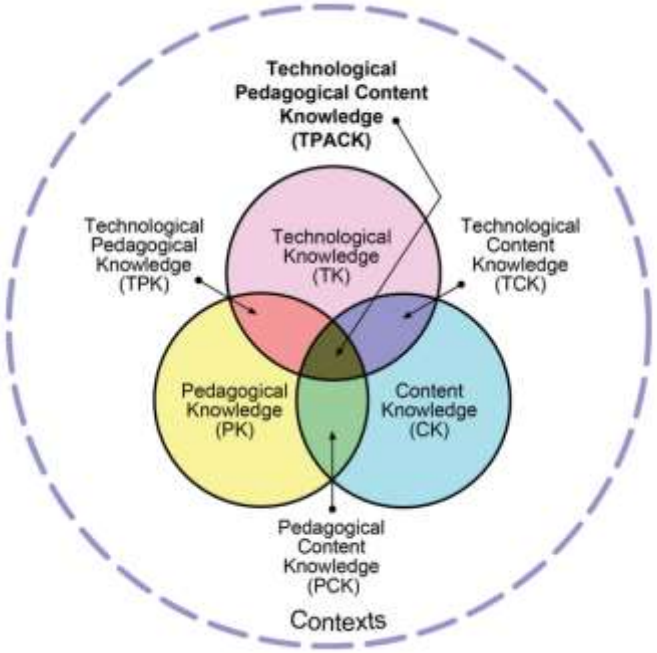


Figure 1. Tpack (source: Reproduced by permission of the publisher, © 2012 by tpack.org)

DigComp 2.0 is another framework that establishes five areas divided in two dimensions of the main components of digital competence. These are summarized in the table No. 1 European Commission (2016).

Table 1: Competence areas dimensions

| | Competence areas dimension 1 | | | | |
|---|---|---|---|---|---|
| | Information and data literacy | Communication and collaboration | Digital content creation | Safety | Problem solving |
| Competence areas dimension 2 | Browsing, searching and filtering data, information and digital content | Interacting through digital technologies | Developing digital content | Protecting devices | Solving technical problems |
| | Evaluating data, information and digital content | Sharing through digital technologies | Integrating and re-elaborating digital content | Protecting personal data and privacy | Identifying needs and technological responses |
| | Managing data, information and digital content | Engaging in citizenship through digital technologies | Copyright and licenses | Protecting health and well-being | Creatively using digital technologies |
| | | Collaborating through digital technologies | Programming | Protecting the environment | Identifying digital competence gaps |
| | | Netiquette | | | |
| | | Managing digital identity | | | |

DigComp 2.0 was updated to DigComp 2.1 this digital competence framework for citizens has eight proficiency levels for each competence, it states and relates action verbs from Bloom's taxonomy and examples of use which helps to the creation of teaching and learning materials, and resources to evaluate the reinforcement or development of digital competence, career guidance and better job opportunities. This framework is composed by 5 dimensions (a) Competence areas identified to be part of digital competence; (b) Competence descriptors and

titles that are pertinent to each area; (c) Proficiency levels for each competence; (d) Knowledge, skills and attitudes applicable to each competence and; (e) examples of use, on the applicability of the competence to different purposes Carretero, Vuorikari, and Punie (2017).

In recent years MOOCs have had great impact on the education field, they have evolved at an accelerated paced due to their characteristics of free access (in most MOOCs there are no entrance requirements), flexibility, virtual interaction, feedback, discussions, evaluations and formal accreditation. One of the most engaging aspect of a MOOC is the fact that students can regulate their own learning goals. MOOCs can make learning accessible to anyone, it doesn't matter the social and cultural background of the participants. With the open environment, MOOCs enable students to converse, collaborate and learn autonomously in a self-regulated way Hernández et al. (2013).

MOOCs structure make use of didactic elements as video-lectures, reading content, quizzes, and activities to present the content to participants. Learning activities are a main aspect on teaching and learning processes with MOOCs. Summative or formative learning activities enhance students learning experience, they motivate and help learners to achieve their learning goals and to finish successfully the MOOC. Within this kind of learning activities exists a group of them that are design with the support of cloud based tools. The cloud-based tools (CBTs), also known as Web 2.0 tools, are highly interactive tools with collaborative features that use cloud computing to scale to hundreds of thousands of users Hernandez and Gütl (2016). It is important to state here that LMSs can also be integrated with CBTs to enhance the learning experience.

Learning activities that require students' interaction, collaboration and sharing ideas, promote a higher-level thinking. Using CBTs within learning activities potentialize higher-order skills such as analysing, evaluating, and creating. CBTs are managed over cloud computing; it is an advantage because is highly scalable in terms of computing to support thousands of active requests Morales et al. (2015). The availability of established technologies and cloud based tools (CBTs) have also contributed to the progress towards flexibility in accessing online courses and the use of collaborative tools Hernández et al. (2013).

MOOCs can offer participants a variety of opportunities to acquire more knowledge or get new skills and competences related to current jobs or give them a path to take other professional directions. In this sense, platforms such as edX, Coursera and Udacity have developed professionalization programs which give the participants the opportunity to obtain academic credits through the purchase of certificates.

Teachers are key drivers of innovation and should be a role model for students' subject learning and use of ICT. The development of these skills in teachers should be introduced from the beginning of teacher education Kay (2006) it is important to take concrete actions toward development of digital skills in future teachers. However, institutions also need to pay attention to teachers who are currently working, and find feasible alternatives to develop these competencies in them. In this sense MOOCs can be a potential format for developing digital competence and lifelong learning.

## "MicroMasters Program eLearning: Crea Actividades y contenidos para la enseñanza virtual" from Galileo University

A multidisciplinary team from Galileo University started in 2016 the design and development of a series of four MOOCs to improve the digital competence of teachers in terms of better knowledge, comprehension, attitudes, information literacy and use of cloud base tools (CBTs) to enhance their practice teaching fields. These four MOOCs were released under the name "MicroMaster eLearning: crea actividades y contenidos para la enseñanza virtual" edX (2017) and were launched in edX as a MicroMasters program.

Information and communication technologies (ICTs) have transformed the workplace demands and society that is why the MicroMasters programs create a bridge between higher education and industry by offering a series of high-quality courses from universities edX partners. This series of courses provide deep learning in specific subjects and fields; courses are recognized by employers for their real job relevance. Students who get a MicroMasters certificate may apply to a full Master's program at university who is offering the MicroMasters program or another university that acknowledges the certificate. A MicroMasters certificate in most cases represents a quarter or a half of a traditional Master's degree, providing the students the chance to advance their career Lapal (2017). Another important aspect about MicroMasters programs is the fact that all the programs are validated by top tier companies to ensure a competitive advantage for career success edX (2018). To successfully earn a MicroMasters credential students must finish all courses, fulfil the requirements (exams, questionnaires, projects, etc.) and earn the Verified Certificate of each course.

1. "Aprendizaje y Enseñanza Virtual" is the first of the four MOOCs. It ran three times (from January 2017 to January 2018 in a self-paced mode and from October 2017 to March 2018 in an instructor mode). It addresses the potential of technology in formal and informal virtual teaching environments by identifying the opportunities and challenges that virtual teaching offer, participants analyse the different elements that must be taken into consideration to carry out an effective design and development of virtual teaching-learning experiences, all this knowledge gives them the opportunity to have the necessary elements to move from the idea to the implementation.
2. "Tecnologías Web Emergentes para la Enseñanza Virtual" is the second of the four MOOCs. It ran three times (from March 2017 to March 2018 in a self-paced mode and from October 2017 to March 2018 in an instructor mode). This MOOC introduces the concept of emerging technologies and cloud based tools, it discusses the use, massification and ubiquity of technology, the new role of teachers and students. It strengthens participants' skills and abilities to develop innovative learning strategies and teaching methodologies.
3. "Diseño y Desarrollo de Recursos Multimedia para la enseñzanza Virtual" is the third of the four MOOCs. It ran three times (from May 2017 to May 2018 in a self-paced mode and from October 2017 to March 2018 in an instructor mode). The main purpose of this MOOC is to provide teachers the necessary training to do a correct integration of technology in their teaching fields. Participants get the skills to design learning activities using Cloud Based Tools. They use their creativity to develop multimedia resources which can efficiently integrate into teaching and learning processes.
4. "Proyecto Final e-Learning" is the last of the four MOOCs. It ran one time from July 2017 to July 2018 in a self-paced mode. The Capstone Project gives the participants the opportunity to demonstrate in a practical way what they have learned from the three MOOCs in the MicroMasters program eLearning; it allows them to apply the knowledge they have gained, working through the challenging and rewarding task of developing their own digital portfolio.

These four MOOCs are offered in Spanish and got more than 27,192 enrolees overall from different countries (see Table 2). The four MOOCs follow a similar structure during five weeks. The content was developed in a series of topics interlaced and dosed in 5 lessons which together provided the scaffolding the students needed to get the knowledge and skills on digital competence. Students expected workload was between 3 to 6 hours per lesson.

Table 2: Enrolees

| MOOCs | Number of enrolees (January 2017 to March 2018) |
|---|---|
| Aprendizaje y Enseñanza Virtual | 8,653 |
| Tecnologías Web Emergentes para la Enseñanza Virtual | 6,644 |
| Diseño y Desarrollo de Recursos Multimedia para la enseñanza Virtual | 7,816 |
| Proyecto Final, “e-Learning” | 4,049 |
| Total | 27,162 |

## MOOCs structure

The structure and sequence of the lessons were conceived to start with basic topics to complex ones. This alignment of lessons ensured an internally consistent structure to help students accomplish their learning goals. Lessons configuration should have a set of instructional design components with a didactic purpose. Videos, reading content, questionnaires, tutorials, formative and summative activities are some of these components Morales et al. (2016).

Each lesson included videos presenting the theoretical concepts, formative activities to reinforce the concepts learned, and summative activities, which were used to calculate learners’ grade in the MOOC. In addition, there were discussion forums and a blog to encourage the construction of learning communities. The summative evaluation system was based on questionnaires that were placed at the end of each lesson, there were a total of four questionnaires with a weight of 20% of the final grade each, and a final exam with a weight of 40% of the final grade. It is important to mention that there was a final exam for the audit learners’ cohort, and another one for verified learners (students who got a verified certificate), this last one had an upper complex level.

The development of this MicroMasters program was fundamentally focused on three aspects: (a) body of knowledge; (b) skills, and (c) competency. Each MOOC was designed with a constructivism, collaborative and a student-centred learning approach (See Figure 2).

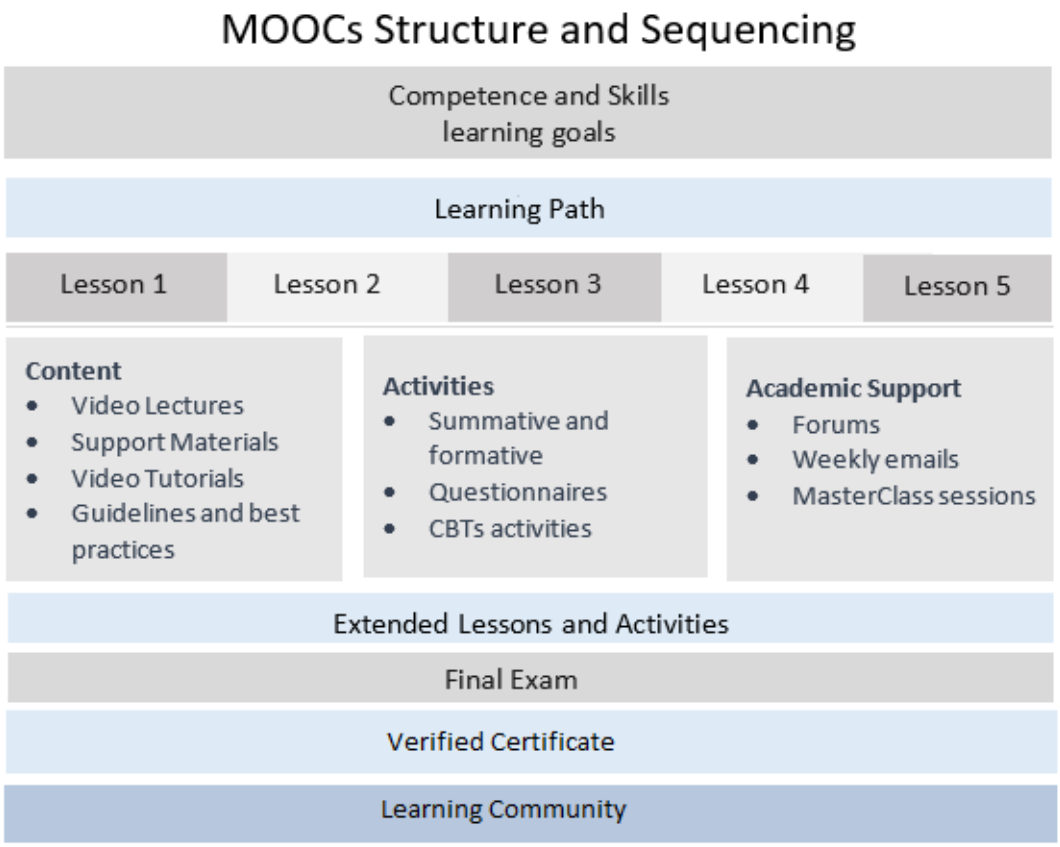


Figure 2. MicroMasters program structure

## Activities

Developing content for a MOOC is a unique experience for faculty. It does present its own challenges. One of these challenges is how to assess teachers' digital competence, how to engage them in activities that allow to practicing, integrating and sharing besides of simply reading and interacting of their own. After reflecting on this issue and try several scenarios, the faculty decided that the best solution to face this challenge was to design learning activities in which students had to use Cloud Based Tools (CBTs).

This type of activities recreates learning situations which require from teachers high-level of thinking, handling information, content, problem solving and collaboration strategies (generic skills). They allow teachers to assess performance, understand the process to design educational resources, share results with peers and tutors, learn and getting feedback from them. A wide range of innovative cloud-based tools can be used in online learning environments and MOOCs, they are well accepted for students and teachers.

## Activities structure design

The design of activities was based on the DigCompEdu Framework, faculty and instructional designers developed an activity template for each MOOC which stated the design requirements that all the activities must fulfilled (see Table 3).

Table 3: MOOC activity design template

| *Name of activity:* | | |
|---|---|---|
| *Learning Objectives:* | Learning objectives must fulfil one or more of these ones.<br>• Provide teachers with CBTs tools that allow them to create their own educational resources.<br>• Allow a reflective practice.<br>• Share their educational resource through forums and community.<br>• Engage collaboration with peers. | Professional engagement (Competence) |
| *Activity Instructions: (Part A, B and C)* | Ask teacher:<br>**Part A:**<br>• Select one CBTs from the list and planning its use.<br>• Consider the specific learning objective, context, pedagogical approach, and target group, when designing his/her activity.<br>• Respect privacy and copyright rules. | Digital Resources (Competence) |
| | **Plan B**<br>Ask teacher to answer these questions<br>• How will he/she plan to implement the activity in his/her teaching process, so as to enhance the teaching interventions?<br>• How will he/she plan to enhance learner collaboration?<br>• What other usage have found for this CBT?<br>• How this activity and tool helps learners? | Teaching and learning (Competence)<br><br>Empowering Learners (Competence) |
| | **Part C**<br>• Design an assessment rubric of his/her activity evaluating different aspects such as knowledge, technical, usability.<br>• Share his/her activity at forums | Assessment (Competence) |

All lessons had at least three activities designed on specific concepts addressed in each lesson, the learning objectives, instructions, requirements and assessment rubrics were shared with teachers. Activities had a difficulty level from medium to high, teachers were required to design and implement activities using CBTs and they also had to plan their use in real-teaching situations (see Table 4). As final step, they shared their results and findings with their peer at forums. These types of activities facilitated the learning process and allowed teachers to advance in the development of their digital competence.

Table 4: Categories and CBTs

| Categories | CBTs |
|---|---|
| Tools to create Mindmaps, interactive presentation and infographics | Canva |
| | Coggle |
| | Emaze |
| Tools for communication and collaboration | Facebook |
| | Twitter |
| | Google+ |
| | Hangouts On Air |
| Tools to create multimedia resources | Soundcloud |
| | Wevideo |
| | Educaplay |
| | Explee |
| | Screencast-o-matic |
| | Quizbean |
| Educational videos | Adobe Spark |
| | Camtasia |
| | Captivate |
| Authoring tools | Storyline |
| | Exelearning |
| | Cuadernia |

Two important things should be remarked about these activities, the first one, the learning activities designed by teachers, not only will help them to improve their digital competence when they have to implement these activities in their own teaching practices, but they are also developing competences by requiring them to organize, process, analyse and interpret information, they also learnt how to communicate and collaborate, how to modify and create digital content in different formats, among many other things; the second one, is that all MOOCs activities were focused in some level of the revised Bloom's taxonomy, and video-tutorials, guidelines, best practices and written instructions were provided to support them with the assignments.

### *Extended lessons and activities*

This section was designed to give teachers additional practice beyond the lecture videos and previous activities. Teachers could not hone their skills just by doing their assignments, they needed to demonstrate critical thinking, and problem-solving skills to improve digital competence. They needed to practice.

Each exercise covered a fundamental concept of digital competence and additional CBTs, extended activities were a little bit more complex than the previous ones. These extended lessons and activities were exclusive for verified learners.

Verified learners were the ones who got a verified certificate. Verified certificates were available for a fee that varies by course. Learners who successfully completed and earned a Verified Certificate in all 3 MOOCs and passed the final capstone project, were eligible to apply to the online Master's program at Galileo University.

### *MasterClass sessions*

These were interactive events hosted by subject specialists who have extensive teaching experience. Specialists built a presentation upon the content of each lesson and allowed learners to participate in live collaborative discussions. Each session lasted an hour in total, including time for questions and answers towards the end. These tutoring sessions were hosted each week using Hangouts On Air tool.

### *Discussion Forums*

These discussion forums were specially designed to discuss specific subjects, they had a clear instruction goal, they were not just to post doubts and comments, students shared points of view, analyse and shared experiences with their peers, and tutors. They were a unique opportunity to interact with learners from all over the world. The community was diverse in experience, knowledge, language and culture.

Each lesson had at least two forums associated, two tutors were in charge of monitoring and answered teachers' questions, clarified concepts, and to provide technical assistance.

### *Learning Community*

It was created a learning community (http://learningmasters.galileo.edu) to motivate teacher's participation in an online community. It is a place where teachers find, share and exchange information related to MOOCs topics, virtual learning, resources, CBTs and other interesting themes for them. In this blog are published about 16 articles monthly, and it has got more than 35,000 visits each month. Even when MOOCs finished the community is open and it provides teachers the timely information needed to stay updated.

Blogs have become a commonplace to exchange information without space and time constraints, another learning platform to develop digital competence Richardson (2005). Blogs can stimulate reading and motivate learning, they allow participants to meet personal needs and interests at the same time.

## Conclusions

The paper has presented the experience of designing, developing and implementing an academic program to improve teachers' digital competence by MOOCs. After running the MicroMasters program three times, it is concluded:

This MicroMasters program, besides providing teachers with the opportunity to learn about digital competence and how to use it in the process to improve their teaching methods and practice, enables the participation in a learning community that provides teachers with a collective construction of knowledge, new professional competences related to ICTs and timely information needed to stay updated.

MOOCs can help to develop a wide range of competences. It is expected that the main motivation of teachers to participate in any of these MOOCs is personal and for professional development. However, teachers should be aware that this competence can be valuable not only for themselves in their own careers, but also their workplaces could benefit from having staff with these competences in their transition towards a digital society and industry. Developing digital competence is therefore a need and a strategic objective.

Teachers are expected to have digital confidence and the necessary training to do a correct integration of technology in their teaching fields. MOOCs can fulfil these expectations. MOOCs are having impact at a global scale on teaching and learning, their potential to provide access to education, flexibility, versatile and capacity to promote innovation, make of them a good strategy to develop teachers' competence.

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