UNIVERSIDAD DE MURCIA

ESCUELA INTERNACIONAL DE DOCTORADO

Estudio del proceso de diseño, creación e implementación de una estrategia de desarrollo de MOOC de la Universitat Politècnica de València

D.Ignacio Despujol Zabala

2022

UNIVERSIDAD DE MURCIA

ESCUELA INTERNACIONAL DE DOCTORADO

Programa de Doctorado en Tecnología Educativa

Tesis Doctoral

Estudio del proceso de diseño, creación e implementación de una estrategia de desarrollo de MOOC de la Universitat Politècnica de València

Doctorando

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UNIVERSIDAD DE
MURCIA

Dª. Linda Castañeda Quintero, Profesora Titular de Universidad del Área de Didáctica y Organización Escolar en el Departamento de Didáctica y Organización Escolar, AUTORIZA:

La presentación de la Tesis Doctoral titulada "Estudio del proceso de diseño, creación e implementación de una estrategia de desarrollo de MOOC de la Universitat Politècnica de València", realizada por D. Ignacio Despujol Zabala, bajo mi inmediata dirección y supervisión, y que presenta para la obtención del grado de Doctor por la Universidad de Murcia.

En Murcia, a 17 de julio de 2022

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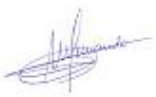
UNIVERSIDAD DE
MURCIA

D. Miguel Ferrando Bataller, Catedrático de Universidad del Área de Teoría de la Señal y Comunicaciones en el Departamento de Comunicaciones, AUTORIZA:

La presentación de la Tesis Doctoral titulada "Estudio del proceso de diseño, creación e implementación de una estrategia de desarrollo de MOOC de la Universitat Politècnica de València", realizada por D. Ignacio Despujol Zabala, bajo mi inmediata dirección y supervisión, y que presenta para la obtención del grado de Doctor por la Universidad de Murcia.

En Murcia, a 18 de julio de 2022



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AGRADECIMIENTOS

Quiero agradecer a Linda su perseverancia y paciencia, sin ella no hubiera terminado esta tesis.

También a Laura, por estar siempre ahí, y a los dos enanos (cada vez menos) por alegrarme la vida.

A mi jefe Jaime y a mi compañero de andanzas Carlos, por formar un equipo de trabajo excepcional con el que siempre es fácil acometer cualquier proyecto. También a los equipos que trabajan con nosotros en MOOC y multimedia, los Nachos, Pablo, Miguel, Fernando y Sergio, excelentes profesionales y personas que consiguen que estos proyectos lleguen a buen puerto.

Y a la UPV y los vicerrectores con los que me ha tocado trabajar, Elías De los Reyes, Miguel Ferrando, Antonio Hervás, Vicent Botti, Virginia Vega y ahora José Pedro García, porque siempre han creído en nuestro trabajo y nos han dejado hacer, apoyándonos cuando hacía falta.

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RESUMEN

La Universitat Politècnica de València (UPV) decidió lanzar una iniciativa MOOC (Massive Open Online Courses*)* a finales de 2012 desde un planteamiento local, único, pero con una mirada puesta en el desarrollo global de este tipo de iniciativas. Teniendo en cuenta las dimensiones de este proyecto, el hecho de que se llevaría a cabo desde cero y que entendemos que las implementaciones institucionales de iniciativas tecnológico-pedagógicas a esta escala son un campo emergente, esta tesis surgió con la idea de documentar el proceso llevado a cabo. Pretendíamos estudiar sus fortalezas y debilidades y estudiar posibles mejoras a incorporar en el futuro, realizando un estudio del caso que sirva tanto para avanzar en la implementación de la plataforma, como para que aquellos que se encuentren en una situación semejante puedan extraer conclusiones del proceso seguido por la UPV.

En este estudio se pretende incorporar la visión de los principales implicados en la iniciativa (administración, profesores y alumnos), quienes configuran la perspectiva de los 3 objetivos específicos de la investigación, caracterizando la experiencia, y permitiéndonos, además, estudiar sus logros y detectar posibilidades de mejora. Así, la tesis se ha realizado por compendio de artículos, dedicando uno al estudio administrativo de la iniciativa, otro a las motivaciones e inquietudes de los profesores, y dos artículos a iniciativas dirigidas a los estudiantes, llevadas a cabo durante la pandemia de COVID-19 para aprovechar los MOOC como recurso de aprendizaje a distancia durante el confinamiento. Además, se ha incorporado un quinto artículo con una revisión exhaustiva de la literatura publicada sobre MOOC realizada incorporando técnicas de aprendizaje automático que permiten estudiar todo lo publicado.

En sus primeros 9 años y medio la iniciativa ha superado los 3,7 millones de inscripciones en más de 100 cursos, ha conseguido gran reputación digital en la disciplina MOOC para la UPV y una buena repercusión mediática y las respuestas a las encuestas de profesores y alumnos indican que tanto unos como otros están satisfechos con el soporte que reciben y con la calidad de los cursos. Todo lo anterior se ha realizado con un equipo compuesto por tres personas y apoyado por alumnos colaboradores a tiempo parcial, modelo que se diseñó de forma iterativa en las primeras ediciones de la iniciativa. La implicación de la institución y el diseño estratégico desde el principio han resultado ser claves para el éxito de esta.

Un hallazgo importante sobre la motivación de los docentes es que todos valoran positivamente haber creado un MOOC y que sus motivaciones son principalmente intrínsecas, estando muy motivados, aunque hay una queja generalizada sobre el poco reconocimiento que la institución ofrece, factor extrínseco que puede llevar a que pierdan su motivación si no se soluciona.

Los estudiantes han respondido mayoritariamente que harán más MOOC y que están dispuestos a pagar por el certificado, y la mayoría de los que los han usado para cubrir las prácticas en empresa durante la pandemia consideran que han obtenido conocimientos similares a los que hubieran obtenido con ellas. Un detalle que merece la pena destacar es el gran desconocimiento que había en la comunidad sobre los MOOC antes de la iniciativa, algo sobre lo que deben incidir las instituciones que hacen MOOC para maximizar el aprovechamiento de las iniciativas.

ABSTRACT

Universitat Politècnica de València (UPV) decided to launch a MOOC (Massive Open Online Courses) initiative at the end of 2012 from a local, unique approach, but with an eye on the global development of this type of initiatives. Considering the dimensions of this project, the fact that it would be carried out from scratch and that we understand that institutional implementations of technological-pedagogical initiatives on this scale are an emerging field, this thesis arose with the idea of documenting the process carried out. We intended to study its strengths and weaknesses and study possible improvements to be incorporated in the future, making a case study that serves to advance the implementation of the platform, and also for those who are in a similar situation, so they can draw conclusions from the process followed by the UPV.

This study aims to incorporate the vision of the main stakeholders involved in the initiative (administration, teachers and students), who form the perspective of the 3 specific objectives of the research, characterizing the experience, and also allowing us to study its achievements and identify opportunities for improvement. Thus, the thesis has been made by a compendium of articles, dedicating one to the administrative study of the initiative, another to the motivations and concerns of teachers, and two articles to initiatives aimed at students, carried out during the COVID-19 pandemic to take advantage of MOOCs as a resource for distance learning during confinement. In addition, a fifth article has been incorporated with a comprehensive review of the published literature on MOOCs carried out incorporating machine learning techniques that allow to study everything published.

In its first 9 and a half years the initiative has exceeded 3.7 million registrations in more than 100 courses, has achieved great digital reputation in the MOOC discipline for the UPV and a good media impact, and responses to surveys of teachers and students indicate that both are satisfied with the support they receive and the quality of the courses. All of the above has been carried out with a team composed of three people and supported by part-time student collaborators, a model that was designed iteratively in the first editions of the initiative. The involvement of the institution and the strategic design from the beginning have proved to be key to its success.

An important finding about the motivation of the teachers is that they all value positively having created a MOOC and that their motivations are mainly intrinsic, being highly motivated, although there is a generalized complaint about the little recognition that the institution offers, an extrinsic factor that can lead them to lose their motivation if it is not solved.

Most students have responded that they will take more MOOCs and that they are willing to pay for the certificates, and most of those who have used them to cover internships during the pandemic consider that they have obtained similar knowledge to what they would have obtained with them. One detail worth noting is the great lack of knowledge in the community about MOOCs prior to the initiative, something that MOOC institutions need to address to maximize the use of the initiatives.

ACRÓNIMOS

MOOC: Massive Open Online Course (Curso Abierto Masivo En línea).
UPV; Universitat Politècnica de València
ML: Machine Learning (Aprendizaje automático)
PNL: Procesamiento del lenguaje natural

CAPÍTULO 1. INTRODUCCIÓN

CONTENIDOS DEL CAPÍTULO

1.1. JUSTIFICACIÓN DE LA INVESTIGACIÓN

La Universitat Politècnica de València (en adelante UPV) lleva desde principios de la década pasada involucrada en el desarrollo de un sistema de creación de vídeo digital de apoyo a la docencia y en el fomento del uso de este tipo de materiales por parte de sus profesores. Ha desarrollado Polimedia, un sistema de grabación de objetos de aprendizaje en vídeo de alta definición que permite grabarlos de forma rápida y sencilla usando estudios audiovisuales de bajo coste (Turró, Cañero y Busquets, 2010) y el programa "Docencia en Red" para estimular el desarrollo de contenidos digitales de aprendizaje por parte de sus profesores, darles soporte y evaluar de forma sistemática la calidad del material producido (Cáceres y Martínez, 2011).

La experiencia acumulada y los procesos y sistemas desplegados con los dos proyectos anteriores (más de 19.000 objetos de aprendizaje grabados, 8.000 de ellos dentro del programa Docencia en Red, más de 1.000 profesores entrenados en la creación de material docente en vídeo de alta calidad (Despujol, 2014) y un canal educativo en Youtube, que en el momento de empezar con la iniciativa MOOC (*Massive Open Online Courses*) tenía 5.000 suscriptores y 1,7 millones de visualizaciones y al redactar este documento tiene más de 13.000 vídeos, casi 208.000 suscriptores y 92,2 millones de visualizaciones (Youtube, 2022), hacían que la UPV dispusiera de muchos de los requisitos necesarios para introducirse en el mundo de los cursos MOOC con relativa facilidad, por lo que, en junio de 2012, tras conocer el fenómeno y analizarlo, se realizó un estudio de viabilidad y la UPV decidió poner en marcha la infraestructura que se describe en esta tesis.

Dado que debíamos llevar a cabo el proceso desde cero y que este es un campo emergente en el que no hay casi literatura, esta tesis surgió con la idea de documentar el proceso llevado a cabo, estudiar sus fortalezas y debilidades y estudiar posibles mejoras a incorporar en el futuro, realizando un estudio del caso que sirva tanto para avanzar en la implementación de la plataforma como para que aquellos que se encuentren en una situación semejante puedan extraer conclusiones del proceso seguido por la UPV.

Así pues, esta tesis nace con el **objetivo** de estudiar el proceso de diseño desarrollo y mejora progresiva por el cual la Universitat Politècnica de València se ha dotado de la infraestructura necesaria para crear e implementar cursos MOOC y pretende analizarlo desde tres puntos de vista fundamentales que se sustentan en sus objetivos específicos: un punto de vista técnico/administrativo, el punto de vista del profesorado y el punto de vista del estudiantado.

La carga de trabajo generada por la gestión de una iniciativa MOOC de estas dimensiones con un equipo reducido, y la irrupción de la pandemia, han hecho que esta tesis doctoral se haya alargado más de lo que hubiera sido deseable, pero esto ha tenido un efecto positivo en sus resultados, ya que nos ha permitido estudiar el uso de los MOOC por la comunidad universitaria durante el confinamiento y disponer de muchos más datos a la hora de realizar el estudio de caracterización de los perfiles y la satisfacción de los alumnos, lo que hace que sus conclusiones, basadas en más de 3,6 millones de inscripciones, sean más generales.

1.2. PRESENTACIÓN DE LA TESIS POR COMPENDIO

Esta Tesis Doctoral se presenta como compendio de artículos de investigación, modalidad regulada en el artículo 20 del Reglamento por el que se regulan las enseñanzas oficiales de Doctorado de la Universidad de Murcia y que exige, como mínimo, tres artículos publicados en revistas indizadas en bases de datos internacionales de reconocido prestigio o en revistas científicas o libros editados de importancia justificada, según los indicios de calidad establecidos por la Agencia Nacional de Evaluación de la Calidad y Acreditación (ANECA).

El listado de las publicaciones que constituyen el núcleo central de esta Tesis Doctoral es el siguiente:

ARTÍCULO I:

Despujol, I., Castañeda, L., y Turro, C. (2018). Developing A MOOC Initiative: Lessons Learned from the Universitat Politècnica de València Experience. Turkish Online Journal of Distance Education, 19(1), 215-233.

URL: https://dergipark.org.tr/en/download/article-file/409720

INDICIOS DE CALIDAD:

- Scimago Journal Rank (SJR. SCOPUS): Factor de impacto SJR = 0.274 (Q3) para el año 2018. CiteScore 2018 = 1.0 SNIP 2018 = 0.618
- Índice h5 de la revista en Google scholar.h5=27
- MIAR (Matriz de Información para el Análisis de Revistas): ICDS (Índice Compuesto de Difusión Secundaria) en 2018: 9.80

ARTÍCULO II:

Despujol, I., Castañeda, L., & Turró, C. (2022). What Does the Data Say about Effective University Online Internships? The Universitat Politecnica de Valencia Experience Using MOOC during COVID-19 Lockdown. Sustainability, 14(1), 520.

URL: https://doi.org/10.3390/su14010520

INDICIOS DE CALIDAD:

- SSCI: JCR SSCI 2020 Q2
- Scimago Journal Rank (SJR. SCOPUS): Factor de impacto SJR = 0.664 (Q2) para el año 2021. CiteScore 2021 = 5 SNIP 2021 = 1.31
- Índice h5 de la revista en Google scholar.h5=103
- MIAR (Matriz de Información para el Análisis de Revistas): ICDS (Índice Compuesto de Difusión Secundaria) en 2021: 9.5

ARTÍCULO III:

Despujol, I., Castañeda, L., y Turró, C. (2022). MOOCs as a massive learning resource for a Higher Education Community. The Universitat Politècnica de València experience using the EdX Remote Access Program. Education and Information Technologies.

URL: https://doi.org/10.1007/s10639-022-11140-2

INDICIOS DE CALIDAD:

- SSCI: JCR SSCI 2020 Q2
- Scimago Journal Rank (SJR. SCOPUS): Factor de impacto SJR = 1.055 (Q1) para el año 2021. CiteScore 2021 = 6.6 SNIP 2021 = 2.121
- Índice h5 de la revista en Google scholar.h5=52
- MIAR (Matriz de Información para el Análisis de Revistas): ICDS (Índice Compuesto de Difusión Secundaria) en 2021: 10,9

ARTÍCULO IV:

Despujol, I., Castañeda, L., y Turró, C. (2022). Understanding MOOC instructors' motivations to improve MOOC sustainability. Education in the Knowledge Society. In press

INDICIOS DE CALIDAD:

- Scimago Journal Rank (SJR. SCOPUS): Factor de impacto SJR = 0.664 (Q2) para el año 2021. CiteScore 2021 = 7.1 SNIP 2021 = 1.743
- Incluida en el Emerging Sources Citation Index de la Web of Science
- MIAR (Matriz de Información para el Análisis de Revistas): ICDS (Índice Compuesto de Difusión Secundaria) en 2021: 9,8

ARTÍCULO V:

Despujol, I., Castañeda, L., Marín V. y Turró, C. (2022). What do we want to know about MOOCs? Results from a machine learning approach to a systematic literature mapping review. International Journal of Educational Technology in Higher Education. In press

INDICIOS DE CALIDAD:

- SSCI: JCR SSCI 2020 Q1
- Scimago Journal Rank (SJR. SCOPUS): Factor de impacto SJR = 2.102 (Q1) para el año 2021. CiteScore 2021 = 11.8 SNIP 2021 = 4.303
- Índice h5 de la revista en Google scholar.h5=43
- MIAR (Matriz de Información para el Análisis de Revistas): ICDS (Índice Compuesto de Difusión Secundaria) en 2021: 10,7

En el proceso de investigación de esta Tesis Doctoral se ha participado en diversos congresos y seminarios y se ha colaborado con autor en diversos artículos en los que se han difundido los avances realizados en la investigación. Se incluye a continuación un listado de resultados, que puede consultarse en el siguiente (https://bit.ly/ORT_IDespujol).

Tabla 1. Relación de congresos, jornadas y seminarios para la difusión de la investigación en el marco de la Tesis Doctoral

NOMBRE	EVENTO	AÑO	FECHA	UBICACIÓN
Analysis of demographics and results of student's opinion survey of a large scale mooc deployment for the spanish speaking community	Frontiers in education conference (FIR) 2014	2014	22 de octubre de 2014	Madrid
Experiencias y resultados de la iniciativa MOOC de la Universitat Politècnica de València	MOOCs. Estado de las tecnologías y experiencias prácticas de las universidades españolas: CRUE TIC	2014	8 de septiembre 2014	Universidad Internacional Menéndez Pelayo - Santander
Open edX onsite	Open EdX Conference 2014	2014	18 de noviembre 2014	Harvard University
Experiencias y resultados de la iniciativa MOOC de la Universitat Politècnica de València	Innovación con Tecnología Educativa Abierta: Casos de Éxito con edX y Open edX. Meetup Madrid	2015	20 de abril de 2015	Universidad Carlos III de Madrid
Sizing an on-premises MOOC Platform. Experiences and tests using Open edX	European MOOC Stakeholders Summit 2015 (EMOOCS)	2015	18 de mayo de 2015	Université Catholique de Louvain - Mons
Del MOOC al SPOC. Una experiencia para el aprendizaje líquido de la Química básica	In-Red 2015 - Congreso nacional de innovación educativa y de docencia en red	2015	30 de junio de 2015	Universitat Politècnica de València
Desarrollo de objetos audiovisuales de aprendizaje para docencia formal y MOOC	IV Jornada de innovación docente de la Universidad de Valladolid. "Los universos docentes"	2016	22 de abril de 2016	Universidad de Valladolid
La experiencia del proyecto UPV [X] en la Universitat Politècnica de València	I Jornada Educación Digital Cátedra Telefónica 2016.	2016	5 de mayo de 2016	Universitat Politècnica de València
La experiencia MOOC de la Universitat Politècnica de València	Conferencia "experiencias en la implementación de MOOCs", ANUIES, Académica (México)	2016	18 de mayo de 2016	Online
Lean MOOC Production	Open EdX Conference 2016	2016	14 de junio de 2016	Stanford University - California

NOMBRE	EVENTO	AÑO	FECHA	UBICACIÓN
Experiencias y expectativas de futuro con MOOCs	Jornada red.es-UC3M sobre formación digital con tecnología abierta	2016	18 de noviembre de 2016	Madrid
Free certificate discontinuation effect on MOOC completion rates	European MOOC Stakeholders Summit 2017 (EMOOCS)	2017	22 de mayo de 2017	Universidad Carlos III de Madrid
Additional Functionalities to convert an xMOOC into an xLMOOC	European MOOC Stakeholders Summit 2017 (EMOOCS)	2017	23 de mayo de 2017	Universidad Carlos III de Madrid
Javascript tools to enhance a language MOOC	Open EdX Conference 2017	2017	25 de mayo de 2017	Universidad Carlos III de Madrid
Diseño, Desarrollo y Evaluación del MOOC “Introducción a la Gestión de Proyectos"	In-Red 2017 - Congreso nacional de innovación educativa y de docencia en red	2017	13 de julio de 2017	Universitat Politècnica de València
Curso “Elaboración de recursos multimedia para la docencia: los MOOC"	Título de especialista universitario en formación online (EUFOL)	2017	28 de julio de 2017	Universitat Politècnica de València
UPV and MOOCs	Presentación a la dirección de la base de la ONU en Valencia	2018	25 de enero de 2018	Universitat Politècnica de València
Lean MOOC Production	OEDO online learning workshop	2018	22 de marzo de 2018	Tokyo Tech
From MOOC to SOOC. An unexpected journey	Open EdX Conference 2018	2018	31 de mayo de 2018	HEC Montreal
Optimizing the emails for students. Analysis of the student's email address domain for a broad MOOC population	Open EdX Conference 2018	2018	31 de mayo de 2018	HEC Montreal
UPV information technologies for education	Presentación a delegación 25 profesores Azerbayán	2018	21 de junio de 2018	Universitat Politècnica de València
Integración del "User Experience Questionnaire Short”	In-Red 2018 - Congreso nacional de innovación educativa y de docencia en red	2018	20 de julio de 2018	Universitat Politècnica de València

NOMBRE	EVENTO	AÑO	FECHA	UBICACIÓN
Are MOOCs going to disappear? MOOC challenges in the coming years	Learning with MOOCs 2018	2018	28 de septiembre de 2018	Universidad Nacional de Educación a Distancia - Madrid
Demystifying Marketing session	edX Global Forum 2018	2018	15 de noviembre de 2018	Boston
Course promotion techniques used by Universitat Politècnica de València	Open EdX Conference 2019	2019	27 de marzo de 2019	University of California San Diego
Macro MOOC learning analytics: exploring trends across global and regional providers	LAK '20: Proceedings of the Tenth International Conference on Learning Analytics & Knowledge	2020	23 al 27 de marzo de 2020	Online
Participation of Latin America in MOOCs: Exploring Trends Across Providers	Learning with MOOCx 2020	2020	30 de septiembre de 2020	Online
Integrating the evaluation of out of the platform autoevaluated programming exercises with personalized answer in Open edX	Learning with MOOCx 2020	2020	30 de septiembre de 2020	Online
Universitat Politècnica de València's Experience with EDX MOOC Initiatives During the Covid Lockdown	European MOOC Stakeholders Summit 2021 (EMOOCS)	2021	22 de junio de 2021	Online
MOOC como estrategia de nivelación en la enseñanza universitaria: el caso de la Universidad Politécnica de Valencia	Campus Virtuales	2021	Enero de 2021	Artículo
Machine Learning para la mejora de la experiencia con MOOC: el caso de la Universitat Politècnica de València	RIITE Revista Interuniversitaria de Investigación en Tecnología Educativa	2021	1 de junio de 2021	Artículo
Large scale analytics of global and regional MOOC providers: Differences in learners' demographics, preferences, and perceptions	Computers and education	2022	7 de enero de 2021	Artículo

Finalmente presentamos en la siguiente página una línea del tiempo donde queda reflejado todo el proceso anteriormente descrito:

ARTÍCULOS REVISTA

TODJE 2018: Developing A MOOC Initiative: Lessons Learned from the Universitat Politècnica de València Experience

RIITE 2021: Machine Learning para la mejora de la experiencia con MOOC: el caso de la Universitat Politècnica de València

Campus Virtuales 2021: MOOC como estrategia de nivelación en la enseñanza universitaria: el caso de la Universidad Politécnica de Valencia

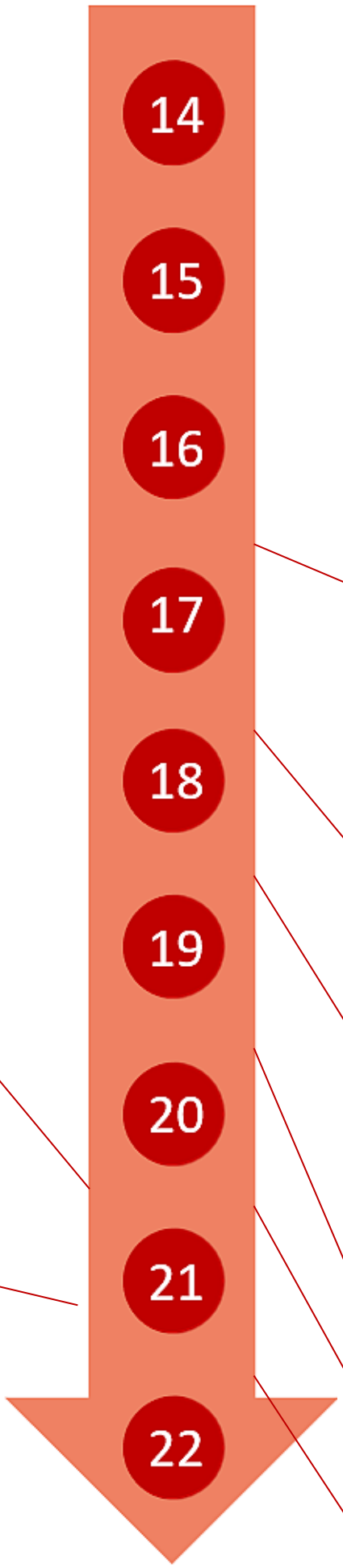
Computers and education 2021: Large scale analytics of global and regional MOOC providers: Differences in learners' demographics, preferences, and perceptions

Sustainability 2022: What Does the Data Say about Effective University Online Internships?

EAIT 2022: MOOCs as a massive learning resource for a Higher Education Community. The Universitat Politècnica de València experience using the EdX Remote Access Program

EKS 2022: Understanding MOOC instructors' motivations to improve MOOC sustainability

ETHE 2022: What do we want to know about MOOCs? Results from a machine learning approach to a systematic literature mapping review



CONGRESOS

FIE 2014: Analysis of demographics and results of student's opinion survey of a large scale mooc deployment for the spanish speaking community

UIMP 2014: Experiencias y resultados de la iniciativa MOOC de la Universitat Politècnica de València

OpenedX conf 2014: Open edX onsite

Meetup Madrid 2015: Experiencias y resultados de la iniciativa MOOC de la Universitat Politècnica de València

EMOOCs 2015: Sizing an on-premises MOOC Platform. Experiences and tests using Open edX

INRED 2015: Del MOOC al SPOC. Una experiencia para el aprendizaje líquido de la Química básica

UVA 2016: Desarrollo de objetos audiovisuales de aprendizaje para docencia formal y MOOC

Catedra Telefónica 2016: La experiencia del proyecto UPV [X] en la Universitat Politècnica de València

ANUIES 2016: La experiencia MOOC de la Universitat Politècnica de València

OpenedX conf 2016: Lean MOOC Production

Red.es 2016: Experiencias y expectativas de futuro con MOOCs

EMOOCs 2017: Free certificate discontinuation effect on MOOC completion rates

EMOOCs 2017: Additional Functionalities to convert an xMOOC into an xLMOOC

OpenedX conf 2017: Javascript tools to enhance a language MOOC

INRED 2017: Diseño, Desarrollo y Evaluación del MOOC "Introducción a la Gestión de Proyectos"

Eufol 2017: Curso "Elaboración de recursos multimedia para la docencia: los MOOC"

ONU Valencia 2018: UPV and MOOCs

OEDO 2018: Lean MOOC Production

Openedx conf 2018: From MOOC to SOOC. An unexpected journey

Openedx conf 2018: Optimizing the emails for students. Analysis of the student's email address domain for a broad MOOC population

Azerbayan workshop 2018: UPV information technologies for education

INRED 2018: Integración del "User Experience Questionnaire Short"

LWMOOCs 2018: Are MOOCs going to disappear? MOOC challenges in the coming years

EdX global forum 2018: Demystifying Marketing session

Openedx conf 2019: Course promotion techniques used by Universitat Politècnica de València

LAK 2020: Macro MOOC learning analytics: exploring trends across global and regional providers

LWMOOCs 2020: Participation of Latin America in MOOCs: Exploring Trends Across Providers

LWMOOCs 2020: Integrating the evaluation of out of the platform autoevaluated programming exercises with personalized answer in Open edX

EMOOCs 2021: Universitat Politècnica de València's Experience with EDX MOOC Initiatives During the Covid Lockdown

1.3. ESTRUCTURA DE LA TESIS

Teniendo en cuenta los objetivos, la estructura y la propia historia de este proceso de investigación, el documento que lo contiene, la presente tesis, tiene una estructura que ha sido pensada en función de la lógica de investigación de esta, si bien, en muchos casos no corresponde a la cronología de su desarrollo –marcada también por las particularidades del mundo editorial–. Así pues, este documento comienza con una introducción en la que se justifica la investigación y se presentan los artículos que constituyen el compendio realizado, incluyendo un listado de los trabajos relacionados con la tesis y que se han llevado a cabo durante su redacción.

En el segundo capítulo se incluyen un marco teórico con apartados para cada uno de los enfoques incluidos en la tesis, complementado por un artículo en el que se presenta una revisión de literatura exhaustiva sobre los MOOC apoyado en técnicas de aprendizaje automático.

El tercer capítulo incluye todos los detalles sobre la aproximación empírica de la investigación, eso incluye los objetivos, la metodología general de la investigación y los procedimientos metodológicos que se han seguido en cada una de las perspectivas asumidas por esta investigación evaluativa.

Luego se incluye un capítulo de resultados en el que, tras una introducción general, se presenta cada uno de los artículos incluidos a medida que se van incorporando. Se ha incluido también un artículo general que caracteriza a los alumnos de la iniciativa que todavía no ha sido aceptado, pues se considera parte integral de esta investigación y entendemos que es una aportación importante a la visión general que se quiere ofrecer. El hecho de que el artículo no haya sido aceptado a fecha de redactar este documento hace que su tratamiento sea algo distinto, apareciendo etiquetado como “investigación” en lugar de como artículo.

Finalmente se incluye un capítulo de conclusiones donde se recopilan las principales conclusiones de cada artículo, un capítulo de limitaciones y un capítulo de futuros trabajos, para acabar con una recopilación de la bibliografía utilizada.

Llegados a este punto, debemos matizar que en el cuerpo del texto los artículos se han numerado cronológicamente por orden de publicación, pero se introducen siguiendo el orden lógico de presentación de los resultados, por lo que aparecen “desordenados” respecto del índice de la tesis. Cada artículo tiene las tablas y figuras con su numeración interna, así para la tesis hemos decidido añadirle Artículo N (con el número correspondiente) delante del nombre de cada tabla y figura, de forma que la numeración siga siendo consistente con la que tienen en el artículo, pero puedan ser incorporadas a los índices y fácilmente localizables en este documento.

CAPÍTULO 2. MARCO TEÓRICO

CONTENIDOS DEL CAPÍTULO

2.1. EL FENÓMENO MOOC

Según McAulay, Stewart, Siemens y Cormier (2010) "Un MOOC es un curso en línea con la opción de inscripción abierta y gratuita, un currículo compartido de forma pública, y resultados de aprendizaje abiertos". Desde que el término fue acuñado en 2008 para darle nombre al curso conectivista *'Connectivism and Connective Knowledge*/2008' (CCK8), ofrecido Stephen Downes y George Siemens de la Universidad de Manitoba (Cormier, 2008), muchas universidades e instituciones han ofrecido cursos de formatos dispares bajo esta denominación y se han creado diversas plataformas de impartición de este tipo de cursos, algunas propietarias, otras de código abierto, algunas promovidas por gobiernos, otras por universidades, otras por asociaciones sin ánimo de lucro y otras por empresas (Class Central, 2014) .

Estos cursos se popularizaron a fines de 2011, cuando la Universidad de Stanford lanzó cursos con más de 100 mil inscripciones cada uno (Rodríguez, 2012). Este éxito considerable atrajo la atención de los medios de comunicación a los MOOC, que lo amplificaron, por lo que 2012 fue llamado por algunos medios el año del MOOC (Pappano, 2012). Algunos artículos llegaron a decir que los MOOC eran la tecnología educativa más importante en 200 años (Regalado, 2012).

A pesar de la diversidad de cursos y plataformas, la mayoría de los MOOC pueden ser enmarcados en tres grandes categorías: basados en la red de aprendizaje, basados en las tareas a desarrollar o basados en el contenido (Lane, 2012), cada una con una metodología y un enfoque pedagógico muy diferentes. Estas tres grandes categorías han dado lugar a una serie de formatos híbridos que combinan sus características (Clark, 2013), como los s-MOOC que fomentan interacción en redes sociales como herramienta integral del proceso de aprendizaje (Brouns et al., 2017) o los t-MOOC que se basan en la creación colaborativa de nuevos cursos por parte de los alumnos como herramienta de aprendizaje (Osuna-Acedo, Marta-Lazo y Frau-Meigs, 2018).

Los cursos basados en contenido, también llamados Xmooc, son los que mayor éxito de público han tenido (Daniel, 2012) y también los que han sido creados mayoritariamente la UPV, por lo que este estudio previo se basa principalmente en ellos.

Estos cursos siguen un enfoque parecido a la enseñanza tradicional, con lecciones en video, exámenes numéricos y de opción múltiple, y foros en línea (Lugton, 2012), lo que ha sido caracterizado por algunos autores como instructivista e individualista (García-Peñalvo, Fidalgo-Blanco y Sein-Echaluce y, 2016).

Por ello pronto aparecieron críticos que comentaron que los MOOC no eran más que una evolución incremental de las tecnologías educativas ya disponibles y que el modelo x-MOOC dominante no introdujo ninguna innovación pedagógica, incluso afirmando que el primer MOOC se creó en 1922 con cursos abiertos en la Universidad de Nueva York transmitidos utilizando una estación de radio (Bartolomé, 2013). Algunos incluso consideraron que los MOOC estaban cerca del pico de expectativas infladas del ciclo de Gartner (Schmidt, 2012).

De hecho, 11 años después del lanzamiento de los primeros xMOOC quedan muchas preguntas por responder sobre la importancia y oportunidad de este fenómeno educativo (Margaryan, Bianco y Littlejohn 2015; Rolfe, 2015; Toven-Lindsey, Rhoads y Lozano 2015, Babori, 2020, entre otros). Algunas de estas preguntas están relacionadas con la necesidad de visiones más críticas sobre la interpretación del papel de los MOOC en el ecosistema de la Educación Superior (ES) (Bulfin, Pangrazio y Selwyn, 2014) y otras con las implicaciones pedagógicas de esos modelos de enseñanza "masivos" (Bartolomé-Pina y Steffens, 2015).

En esos años, algunos de los desafíos más críticos para los MOOC fueron lograr la autosostenibilidad y encontrar fuentes de ingresos y formas de mantener bajos los costes (Conole, 2014; Shah, 2016; Schuwer et al., 2015). Según Hollands y Tirthali (2014) el costo por MOOC para las universidades está en el rango de $ 39.000 a $ 325.000; un coste que concuerda con el rango de 86.400-96.000 euros mencionado por Elpeboin (2016). Este hecho hace que las iniciativas MOOC sean difíciles de incluir en las políticas de educación superior (O'Connor, 2014), así como difíciles de justificar en un contexto de crisis económica (Pedreno, Moreno, Ramón y Pernias, 2013).

Algunos artículos señalan cuatro grandes barreras que los MOOC tienen que superar todavía: desarrollar modelos de ingresos para que el concepto sea autosostenible; entregar evidencias de finalización que el mercado considere valiosas, como credenciales, insignias o aceptación en programas acreditados; aumentar el porcentaje de alumnos que finalización los cursos; y crear formas de autenticar a los estudiantes que satisfagan a las instituciones acreditadoras o a las empresas de contratación (Hill, 2012).

Actualmente, los MOOC, más que un término, se han convertido en un fenómeno que representa una de las iniciativas más influyentes en la Educación Superior, con el objetivo de adoptar y utilizar de manera efectiva las características de las tecnologías digitales más populares, todas ellas con más de una década de historia (Rodríguez, 2012). De hecho, a pesar de las críticas y los problemas mencionados, once años después de su primer éxito, el movimiento MOOC se ha expandido cada año, con más de 19.400 cursos de 950 universidades de todo el mundo que inscriben a más de 220 millones a finales de 2021 -excluyendo a los proveedores de MOOC de China- (Shah, 2021), y miles de plataformas que ofrecen MOOC que van desde plataformas globales y nacionales hasta pequeñas plataformas de nicho (OpenedX, 2018, OpenedX, 2021).

2.2. LOS MOOC Y LA EDUCACIÓN SUPERIOR

Muchas universidades de todo el mundo comenzaron a experimentar con cursos MOOC desde el comienzo del movimiento (Shah, 2013). Sin embargo, una de las grandes preguntas que rodean el compromiso de las universidades con el desarrollo de MOOC es hasta qué punto estos cursos -su creación y uso- pueden contribuir a desarrollar los objetivos de HE (Papadimitriou, 2020) y no solo a su uberificación (Adell, Castañeda y Esteve-Mon, 2018).

EdX comenzó a ofrecer Micromasters in 2016 (microcredenciales que dan acceso a créditos académicos), y Coursera siguió en 2018 con master track (McIntyre, 2018). En los

últimos años las plataformas MOOC más importantes se han ido alejando del modelo "abierto" buscando su rentabilidad, haciendo que parte de su contenido sea solo accesible para aquellos que pagan (primero los certificados, luego las tareas calificadas) (Shah, 2017).

El modelo MOOC en las grandes plataformas ha ido cambiando hacia un modelo de negocio bien establecido –el de posgrado y educación continua en línea– y actualmente la mayoría ofrece ya microcredenciales con créditos académicos (Pickard, Shah y De Simone, 2018). De hecho, los MOOC se utilizan en uno de los programas de posgrado en línea con más éxito de los Estados Unidos de América (EE. UU.), el Máster en Ciencias en Línea en Ciencias de la Computación (OMSCS) del Instituto de Tecnología de Georgia, con más de 5.000 estudiantes graduados desde que comenzó en 2013 Nieztel (2021). Este máster fue pionero en un primer momento en el que muy pocas universidades crearon titulaciones de este tipo basadas en MOOC, tendencia que cambió en 2018, año en se aceleró de forma significativa el número de programas de este tipo desarrollados, existiendo en el momento actual más de 70 programas de posgrado en línea basados en MOOC de 27 universidades distintas Ledwon (2021).

Hay experiencias de universidades que otorgan créditos académicos por MOOC de otras universidades desde antes de que se desatara la pandemia de COVID-19 en 2021. Algunas integran MOOC en cursos semipresenciales (Khan, 2019), otros aceptan credenciales de micromaster como parte de uno de sus másteres (edX, 2021; MIT, 2021), algunos los utilizan en redes interuniversitarias como un programa de intercambio virtual (Delft University, 2021), y otros permiten a los estudiantes crear un módulo de sus estudios de licenciatura utilizando MOOC (NUS, 2021).

2.3. LOS PROFESORES DE LOS MOOC

Los MOOC han sido objeto de miles de trabajos de investigación centrados principalmente en los estudiantes, incluidas sus experiencias, satisfacción, motivaciones, patrones de interacción y resultados de aprendizaje. Según el artículo de revisión de literatura incluido en esta tesis, hay más de 15 revisiones de literatura sobre el tema, que van desde 2013 (por ejemplo, Liyanagunawardena, Adams y Williams, 2013) hasta tiempos más recientes (por ejemplo, Babori, 2020 o Rasheed et al., 20q9). Un pequeño porcentaje de toda esta investigación se ha centrado en los instructores de MOOC (Blackmon, 2018; Roth, 2013; Kolowich, 2013; Zheng et al., 2016; Blackmon, 2018; Gonçalves y Gonçalves 2019) y una pequeña fracción sobre cómo el desarrollo de MOOC afecta a los instructores de MOOC en su motivación y desarrollo profesional (Kolowich, 2013; Lowenthal et al., 2018; Young Doo et al., 2020).

Se requiere mucho tiempo y esfuerzo para diseñar y desarrollar MOOC (Zhu et al., 2018), y los cursos se ofrecen de forma gratuita o por una tarifa mínima, por lo que comprender las motivaciones y frustraciones de los instructores que desarrollan MOOC es importante para la sostenibilidad a largo plazo de la iniciativa.

Varios estudios previos destacan que a los instructores de MOOC les mueven principalmente incentivos intrínsecos en lugar de extrínsecos (Lowenthal et al., 2018; Najafi et al., 2015). Estas motivaciones incluyen la pasión de un instructor por enseñar su tema de especialización, el deseo de fomentar innovaciones en la enseñanza y el aprendizaje, y la creencia de que los MOOC son una buena herramienta para promover la igualdad educativa (Hew y Cheung, 2014; Lowenthal et al., 2018). Los incentivos extrínsecos incluyen la oportunidad de aumentar la publicidad y la influencia (Kolowich, 2013; Lowenthal et al., 2018) y promover (Hew y Cheung, 2014). Todos estos estudios concluyen que los instructores piensan que la enseñanza de MOOC vale la pena.

Sin embargo, los estudios también indican que los instructores a menudo carecen de una preparación profesional adecuada en la enseñanza en línea (Zhu et al., 2018). El número de matrículas, las diferentes expectativas, las circunstancias personales de los alumnos (con muchos de ellos que no tienen la intención de terminar los cursos) (Hew y Cheung, 2014), la distancia y el uso de una plataforma tecnológica los convierten en un entorno de construcción y transmisión de conocimientos muy diferente de las aulas tradicionales (Ross et al., 2014).

2.4. LOS ALUMNOS DE LOS MOOC

La caracterización de los estudiantes, sus problemas, inquietudes y nivel de satisfacción es uno de los temas más tratados en la literatura científica, lo que puede constatarse en muchas revisiones de literatura (Liyanagunawardena, Adams y Williams 2013, Bozkurt, Keskin y de Waard 2016, Hew, y Cheung 2014, Rasheed et al. 2019, Zhu, Sari y Lee 2018). Esto es algo razonable, pues se trata de la perspectiva humana y más deseable del impacto de esta disrupción tecnológica en algo que es un servicio público.

Para tener una idea de los datos disponibles sobre los alumnos que se inscriben en los cursos MOOC de otras plataformas hemos utilizado informes de recopilación de documentación (Haggard et al.,2013 y Liyanagunawardena, Adams y Williams, 2013), estudios de recopilación de políticas (Grainger. 2013) e informes específicos de los productores de MOOC.

Se han publicado muchos artículos en los que se caracterizan los estudiantes de distintas iniciativas MOOC y los parámetros de su interacción con los cursos y que coinciden en su descripción. De acuerdo con los estudios publicados por Jordan (2014) y Kolowich (2013), en el MOOC promedio en los primeros años de la iniciativa MOOC la inscripción era de entre 35.000 y 43.000 estudiantes, la tasa de finalización media era de entre 6,5% y 7,5% y había una relación negativa entre la duración del curso y las tasas de finalización. Koller et al. (2013) indican que, en 2012, en el MOOC típico de Coursera se inscribieron entre 40.000 y 60.000 estudiantes, de los cuales el 50 y el 60% accedieron al contenido del curso y el 5% obtuvo un certificado.

Rodriguez (2012) estudió los cursos que llevaron a la popularización del fenómeno MOOC. En otoño 2011, en el curso CS221 de la Universidad de Stanford sobre Inteligencia Artificial la matrícula fue de 160.000, de los que 20.000 completaron el curso (12,5%), en el

curso "*Machine Learning*" se matricularon 104.000 estudiantes de los que 13.000 (12,5%) completaron el curso y en el de "Introducción a las bases de datos" tuvieron 92.000 inscripciones de los que acabaron 7000 (7,6%) [12]

También hay un estudio de Gee (2012) sobre el primer MOOC del MIT, el curso de MITX 6002x, en el que la matrícula fue de 154.764, de los cuales 69.221 (45%) accedieron al primer grupo de problemas, 26.349 (17%) obtuvo al menos 1 punto en él y 7.157 (4,6%) obtuvieron el certificado.

Ho et al. (2014) comentan en su artículo que en el año que va del otoño de 2012 al verano de 2013, edX registró 841.687 inscripciones en los 17 cursos del MIT y Harvard, de las que 548.835 (65%) interactuaron con el contenido, 35.937 (4,3%) accedieron a al menos la mitad del contenido y 43.196 (5,1%) obtuvieron un certificado de superación. Harrison (2013) añade que en los 6 cursos ofrecidos por la Universidad de Toronto en Coursera entre julio 2012 y julio 2013 se inscribieron 366.424 usuarios de los cuales 115.042 (31,4%) vieron al menos un vídeo y 17.794 (4,9%) completaron los cursos. Según Kevat (2014), en los 32 cursos incluidos en las 7 cohortes lanzadas en la plataforma australiana Open2study, se matricularon 125.843 estudiantes de los que más del 25% completaron con éxito los cursos.

Con respecto a la formación previa de los estudiantes, en el estudio de Ho et al. (2014) se comenta que el estudiante típico en un MOOC del MIT y Harvard en edX es un varón con título de grado de entre 26 y 50 años, pero que hay diferencias considerables entre los datos demográficos de las distintas materias. Koller y NG (2013) reseñan que la mayoría de los estudiantes de Coursera tienen estudios universitarios, el 42,8% tienen estudios de grado, el 36,7% estudios de máster y un 5,4% estudios de doctorado. Según Harrison (2013), en los 6 cursos desarrollados por la Universidad de Toronto en Coursera el 80% de los inscritos tenían estudios de grado o superiores, con un ligero predominio de hombres (52%) y edades comprendidas entre los 26 y los 45 años. Balch (2013) comenta que en la edición de primavera 2013 del curso de Coursera "*Computational Investing, Part I*", los estudiantes tenían entre 16 y 88 años de edad, con una media de 34 años para los que no lo completaron y de 35 para que los que sí. La mayoría de estudiantes eran varones (89% para los que no completaron y 94% para los que sí) y el 85% tenían un título de grado o superior. Y Belanger y Thornton (2013) reseñan que, de los estudiantes matriculados en el curso Biolectricity de la Universidad de Duke en Coursera en otoño de 2012, el 72% tenía un título de grado o superior.

Todos estos datos demográficos son consistentes e indican que el usuario típico MOOC es un varón de entre 25 y 45 años y que los MOOC están siendo utilizados por los que ya tienen una educación superior. El trabajo de Emanuel (2013) sobre los estudiantes inscritos en los cursos de Coursera de la Universidad de Pennsylvania confirma el predominio de estudiantes con estudios superiores. El autor llega a la conclusión que los MOOCs no están cumpliendo con su objetivo inicial de llegar a los estudiantes desfavorecidos que no tienen normalmente acceso a las oportunidades educativas. Yuan y Powell (2013) coinciden con esta apreciación, comentando en su trabajo que parece que para tener éxito en un entorno MOOC es necesario tener un nivel de alfabetización digital más bien alto, lo que podría exacerbar brechas digitales preexistentes.

Las tasas de deserción escolar de los MOOC y las bajas cifras de finalización son una preocupación significativa que se ha abordado ampliamente en la literatura (Khalil y Ebner, 2014; Dalipi, et al. 2016; Almahdi y Sulfeeza 2017; Eriksson, Adawi y Stöhr 2017; Mehrabi, ' y Keshtkar 2020). Pero no hay consenso en que estas cifras sean realmente un signo de fracaso (Balch 2013), y algunos autores afirman que la intención de los alumnos debe tenerse en cuenta al definir el éxito de los MOOC (Koller et al. 2013). De hecho, las tasas de finalización de los estudiantes que buscan un certificado son mucho más altas (Chuang y Ho 2016). Koller et al. (2013) y Ho et al. (2014) hablan de cifras de inscripción altas y de tasas de terminación que son un porcentaje bajo de las primeras, pero, dadas las bajas barreras de entrada y la diversidad de intereses de los estudiantes que se matriculan, hay un consenso en torno a que la tasa de finalización por sí sola no es un buen indicador del éxito de un curso MOOC y de que hace falta elaborar métricas más sofisticadas.

2.5. LOS MOOC DURANTE LA PANDEMIA

Cuando el COVID-19 golpeó al mundo a principios de 2020, muchos países impusieron confinamientos masivos para detener la propagación de la enfermedad, la mayoría de los cuales incluyeron el cierre de escuelas y universidades (Hale et al., 2021). En este escenario, los MOOC fueron una excelente opción para abordar la necesidad de material en línea de calidad para las instituciones de educación superior (Ponce Ceballos y Ruelas Mexía 2021; Duan 2021).

La pandemia se convirtió en una prueba de fuego para los MOOC y su potencial, no solo como recursos gratuitos para complementar la educación formal, sino como recursos de aprendizaje estratégicos para el desarrollo profesional dentro y fuera de las instituciones de todo el mundo. Los confinamientos revelaron fortalezas y debilidades de las iniciativas en línea, ofreciendo una oportunidad extraordinaria para probar posibilidades de los MOOC que hasta ese momento eran impensables, pero que se convirtieron en la única opción dadas las circunstancias.

Por ejemplo, cuando el COVID-19 forzó el confinamiento en muchos países, los MOOC se utilizaron para capacitar a los maestros para la transición repentina al aprendizaje en línea (Mays et al., 2021; Boltz et al., 2021) o preparar al personal sanitario para el COVID-19 (Seale et al., 2021; Quijano-Escate et al. 2020; Utunen et al. 2020).

Las preguntas sobre lo que los MOOC aportan a la Educación Superior, una vez que hemos pasado -aunque parcialmente- ese momento de "emergencia", siguen ahí, y necesitamos aprovechar las experiencias de estos momentos de implementación para responder a estas preguntas o al menos para acuñarlas como experiencias que enriquecerán nuestro trabajo futuro.

2.6. INVESTIGACIÓN SOBRE MOOC

Con este nivel de éxito y desarrollo, no es de extrañar que el término MOOC haya sido objeto de estudio en un número impresionantemente alto de revisiones de literatura que van desde 2013 (por ejemplo, Liyanagunawardena, Adams y Williams, 2013) hasta tiempos más recientes (por ejemplo, Babori, 2020). La mayoría de esas obras coinciden con un punto que parece que los problemas originales no se han resuelto, y los MOOC todavía están luchando con bajas tasas de finalización y el hecho de que la mayoría de sus estudiantes son individuos educados de los países más ricos del mundo en lugar de aprendices iniciales (Reich y Ruipérez-Valiente, 2019), no quedando claro el papel real de los MOOC en la educación superior y si el esfuerzo vale la pena.

Las revisiones de la literatura sobre MOOC han cubierto tamaños de muestra muy diversos de publicaciones (que van desde menos de 10 a más de 300 publicaciones), diferentes períodos y rangos de publicación (de 2 a 9 años) y hallazgos variados con respecto a lo que ya se sabe sobre estos cursos. La mayoría de estas revisiones analizan los orígenes de los MOOC, su método de investigación y recopilación de datos (estudios cualitativos o cuantitativos), y los temas más frecuentes. Algunos incluyen una clasificación de temas o grupos de temas en los trabajos analizados.

Sin embargo, en la literatura especializada solo aparecen estudios parciales de algunos de los aspectos de las experiencias educativas que han usado MOOC de una forma continuada a lo largo de estos años, como el estudio de los inscritos en la iniciativa Telescope y su participación en la misma (Morales, Rizzardini y Gütl 2014), la descripción de SAWYAM, la iniciativa MOOC de la India (Kanjilal y Kaul 2016) o los estudios recogidos en la revisión de literatura sobre la iniciativa MOOC de Malasia (Albelbisi y Yusop 2020). Un repaso de las revisiones de literatura publicadas sobre MOOCs (Liyanagunawardena, Adams y Williams 2013, Bozkurt, Keskin y de Waard 2016, Hew, y Cheung 2014, Rasheed et al. 2019, Zhu, Sari y Lee 2018) permite comprobar que no incluyen aproximaciones globales que analicen las iniciativas que se ponen en marcha desde los diferentes ámbitos de la complejidad propia de la Educación Superior.

Haciendo una revisión de los títulos de los artículos incluidos en la búsqueda vemos que no hay estudios que traten de forma integral la creación de una plataforma MOOC teniendo en cuenta los aspectos relativos a la parte administrativa/técnica, los profesores y los alumnos, lo que refuerza la pertinencia de la tesis propuesta.

Para conocer en profundidad lo que se ha escrito en la literatura científica sobre los MOOC, en esta tesis se ha incluido una revisión exhaustiva de literatura haciendo uso de algoritmos de aprendizaje automático. Esta revisión, publicada como artículo y que se puede consultar en el apartado siguiente, ha incluido toda la literatura científica indexada en la Web of Science y SCOPUS hasta finales de 2020, consistente en más de 6000 publicaciones.

2.7. ARTÍCULO V: “What do we want to know about MOOCs? Results from a machine learning approach to a systematic literature mapping review”

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What do we want to know about MOOCs? Results from a machine learning approach to a systematic literature mapping review

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Abstract: By the end of 2020, over 16,300 Massive Open Online Courses (MOOCs) from 950 universities worldwide had enrolled over 180 million students. Interest in MOOCs has been matched by significant research on the topic, including a considerable number of reviews. This study uses Machine Learning techniques and human expert supervision to generate a comprehensive systematic literature mapping review that overcomes some limitations of the traditional ones and provides a broader overview of the content and main topics studied in the specialized literature devoted to MOOCs. The sample consisted of 6,320 publications automatically classified within six research topics, denominated by human experts: institutional approach, pedagogical approach, evaluation, analytics, participation, and educational resources. The content analysis of the topics identified was conducted using visual network analysis, which supported the identification of different thematic sub-clusters and endorsed the classification. Results from the review show that the lowest production of MOOC papers is within the topics of the pedagogical approach and educational resources. In contrast, participation and evaluation are the most frequent ones. Also, the most cited papers are in the topics of analytics and resources, being pedagogical approach and institutional approach the less cited. This highlights the need for more MOOC research from a pedagogical perspective and calls upon the presence of educators.

Keywords: MOOCs, Machine Learning, Clustering

1. Introduction

Massive Open Online Courses (MOOCs) is a term coined in 2008 by David Cormier and Bryan Alexander to name the experience created when Stephen Downes and George Siemens launched their course 'Connectivism and Connective Knowledge/2008' (CCK8) and worked and learned actively with 2,200 people (Siemens, 2012). But more than a term, MOOCs are a phenomenon that represents one of the most influential initiatives in Higher Education, aiming to adopt and use effectively the most popular digital technologies' features, all of which with more than a decade of history (Rodriguez, 2012).

This influence in the day to day of universities all over the world –at the end of 2020 there were over 16,300 courses from 950 universities worldwide and more than 180 million enrolments (Shah, 2020) ¬–, and the amazing data generated by the experiences –precisely because of the massive character of the courses–, has fostered the generation of a variety of studies and analysis about their implementation, and a vast amount of literature on the topic. Illustratively, by the end of 2020, over 4000 records included the keyword MOOC in their title or abstract in the Web of Science (WOS) database, and more than 5100 records did it in the Scopus database. Therefore, the term MOOC has been the object of study of an impressively high number of literature reviews ranging from 2013 (Liyanagunawardena et al., 2013), until more recent times (Babori, 2020).

Nevertheless, despite their conclusions being interesting and valuable, and given the vast amount of existing literature, the sample size of those reviews, the sampling mechanisms used in systematic literature reviews and other of their traditional limitations (Davies, 2000; Widiger et al., 1990), the conclusions obtained from these literature reviews remain partial and is very difficult to generalize knowledge about what the specialized literature says about what has been already studied about MOOCs.

In this paper, we propose an alternative approach to a literature review that, using machine learning (ML) and Visual Network Analysis (VNA) techniques, provides researchers and stakeholders with a realistic overview of the content and main topics studied in the specialized literature regarding MOOCs published and indexed in two of the main databases (WOS and SCOPUS) until the end of 2020. This overview aims at describing the produced literature about MOOCs by highlighting the main group of topics that can be found in the published studies (clusters), their relevance and impact and the influence between them. It helps to highlight the priorities these studies had and the topics they did not address. With these two techniques, we aim at offering a complementary and more comprehensive vision to previous literature reviews on MOOCs, looking at the whole picture of what has been published.

2. Literature Reviews regarding MOOCs

MOOCs have sparked an outstanding interest among the educational technology research community. Acknowledging the number of studies already conducted on MOOCs, many authors have also conducted very interesting literature reviews to map what we already know about MOOCs.

The previous literature reviews on MOOCs have covered very diverse sample sizes of publications (ranging from less than 10 to over 300 publications), different publication periods and ranges (from 2 to 9 years) and varied findings regarding what is already known about MOOCs. Most of these reviews analyzed MOOCs' origins, their research method and collection of data (qualitative or quantitative studies), and the most frequent topics. Some include a classification of topics or groups of topics in the papers analyzed.

To provide an overview of some of these literature reviews and their specific findings, they have been synthesized in Table 1.

Artículo V Table 1. *Synthesis of literature reviews on MOOC research.*

Review	N	Period	Findings
Babori (2020)	100 papers	2012-2018	Four categories of research were identified: 1) learning process (39%), 2) predictors of retention (17%), 3) learning experiences (21%) and 4) design of MOOCs (23%). 45% of the articles did not have an identifiable theoretical framework, and the rest of the frameworks were centered on learning analytics.
Bozkurt et al. (2017)	362 papers	2008-2015	Three research areas out of 15 concentrated more than half of the research, most articles focused on xMOOCs, and their discourse is mostly neutral (56%). However, articles with a positive outlook (27%) outweighed those that are negative (1%) or critical (16%).
Bozkurt et al. (2016)	51 theses & dissertations	2008-2015	Education, engineering and computer science and information and communication technology are the main disciplines within MOOC research. Qualitative methods were preferred, and half of them did not have a theoretical framework, the documents studied mainly xMOOCs and focused mainly on MOOC learners and MOOC systems with an educational perspective.
Deng and Benckendorff (2017)	53 papers	2014-2016	Most articles used only one research method. Surveys, interviews, and log files extracted from MOOC platforms were the most common sources of information, with diary studies and focus groups being less common.
Ebben and Murphy (2014)	25 papers	2009-2013	It distinguishes two MOOC development phases: one focused on connectivism and a second one based on xMOOC rise and development.
Hew and Cheung (2014)	25 papers	----	Motivations and challenges of using MOOCs by students and instructors were studied, trying to identify issues not fully addressed or resolved.
Kennedy (2014)	6 papers	----	Key characteristics of MOOCs: varied definitions of openness, barriers to persistence with a high dropout

			rate and a distinct structure with two pedagogical approaches, XMOOCs and CMOOCS.
Liyanagunawardena et al. (2013)	45 papers	2008-2012	Eight categories: introductory, concept, case studies, educational theory, technology, participant focused, provider focused, and other.
Raffaghelli et al. (2015)	60 papers	2008-2014	Nine research aims: Methodological approaches to study MOOCs, Literature review, Institutional development, Teaching processes, Technological tools, Pedagogy, Contribution to educational theory, Learning processes, Learning design.
Rasheed et al. (2019)	311 papers	2009-2018	MOOC research is done mainly in the United States and a few European countries. Most of the studies used quantitative (53%) or mixed (30%) research methods and used one data collection method (75%) They also identified 18 key topics (addressing learners' completion/dropout/retention was the most popular with a percentage of 12.9%).
Sa'don et al. (2014)	164 papers	2008-2014	10 nascent research trends in MOOC research, ordered by their relevance: Pedagogy, Assessment and accreditation, Engagement or motivation, Knowledge sharing, Cultural diversity, Technology, Social Interaction, Participant retention, Learning analytics and Policy and Instructional design.
Sangrà et al. (2015)	228 papers	2013-2014	The authors identified 11 areas and found that Pedagogical strategies, Student engagement and motivation, the Role of social networks in teaching and learning and Consequences for Higher Education systems were the most popular focus areas.
Veletsianos and Shepherdson (2016)	183 papers	2013-2015	They studied geographic distributions of the authors, publication outlets (journals or conference proceedings), data collection and analysis methods (with 8 categories for data collection and 11 categories for data analysis), citations on Google Scholar and research strands (student-focused, teacher-focused, design focused, context and impact, other).
Yousef et al. (2014)	84 papers	2008-2013	It classifies papers in 7 dimensions: concept, design, learning theories, case studies, business model, targets groups, and assessment.
Zhu et al. (2018)	146 studies	2014-2016	Most studies used quantitative research methods (46%), followed by mixed research methods (36%). Among the foci of that research, learner retention and motivation were the most mentioned, followed by learner experience and satisfaction, assessment, and instructional design. They also identified 24 key topics.

All these reviews provide very valuable conclusions for the field, but they have a common limitation, the size of their samples. Eight out of the 15 reviews in the table work with a sample of

fewer than 100 papers. The wider one was the one made by Rasheed et al. (2019), that studied 311 papers from 2009 to 2018. Although most use the human potential and expertise of their authors to analyze and attempt to consolidate a classification of the literature on MOOCs, the low representativeness of these samples, compared to the entire corpus published on the subject, makes most of them more a sampling of the interests of MOOC researchers around the world than a complete picture of MOOC research.

3. Research Questions

This research aims to analyze MOOC-related publications appearing in specialized databases since the emergence of the term associated with education, using ML and VNA techniques. In doing this, the study focused on exploring four main aspects corresponding with the main research questions, as follows:

- RQ1: What groups of topics (Thematic Clusters) can we identify in the literature studied using ML techniques?
- RQ2: How can we characterize each thematic cluster based on the relationships established between the terms it handles (SNA)?
- RQ3: What relationships of relevance, impact or influence can we identify between the different thematic clusters?
- RQ4: What is the missing MOOC research?

3. Methodology

3.1. Sample and Procedure

To answer those specific research questions, a systematic literature review has been conducted. Gough et al. (2017) state that traditional systematic reviews involve three key activities: identifying relevant research, critically reviewing the identified research reports in a systematic manner that can be reproduced, and synthesizing research findings to guide researchers in planning future studies.

Considering the popularity and considerable research on MOOCs over the years, using a systematic review approach can summarize all research and help to identify research gaps to move the MOOC research forward. This study specifically applies a mapping approach or "systematic mapping", since it focuses on describing the research field rather than synthesizing findings (Newman & Gough, 2019).

To collect the sample, the first step consisted of a simple query for the keyword "MOOC" in the title, abstract and keywords fields in two of the most relevant literature databases over the world: Web of Science (WOS), and SCOPUS (as of December 19, 2020). These two databases are considered the most widely used reference databases in the scientific and academic fields (Archambault et al., 2009) and are reliable to be considered principal systems for systematic reviews (Gusenbauer & Haddaway, 2020).

The results were downloaded in CSV (comma separated values) format files and joined in an Excel data model. As in any machine learning project, data understanding and data preparation phases were needed before applying the machine learning algorithms (Mayo, 2018).

The data was consolidated in a single table with columns for the year, title, abstract, and authors. After analysing the data in the data understanding phase, a couple of issues were detected for the data preparation phase: first, MOOC acronym is used in Optics and Oxide field with other purposes, so a filter was applied with these two words in the abstract and all the non-relevant articles were eliminated. And second, the duplicated articles in the two databases sometimes contained slight differences in titles, and abstracts (for example different number of spaces, some differences in the capitalization of letters or different punctuation symbols) that made automatic elimination of duplicates by comparison imperfect, so extra fields were prepared with the 100 first characters in lower case from title and abstract fields, after eliminating spaces and punctuation symbols, to use them with the eliminate duplicates function of excel. Finally, the table was ordered

alphabetically by the title field and a manual revision of the resulting table was conducted to detect duplicates not eliminated by the former processes. The table ended with 6320 rows.

Different reviews have already been conducted on MOOCs. However, the particularity is that Machine Learning (ML) algorithms (unsupervised machine learning) have been used instead of manually identifying research and reviewing it, to see if the obtained results are like the ones from former reviews done manually and, therefore, if systematic reviews can be optimized in time and resources.

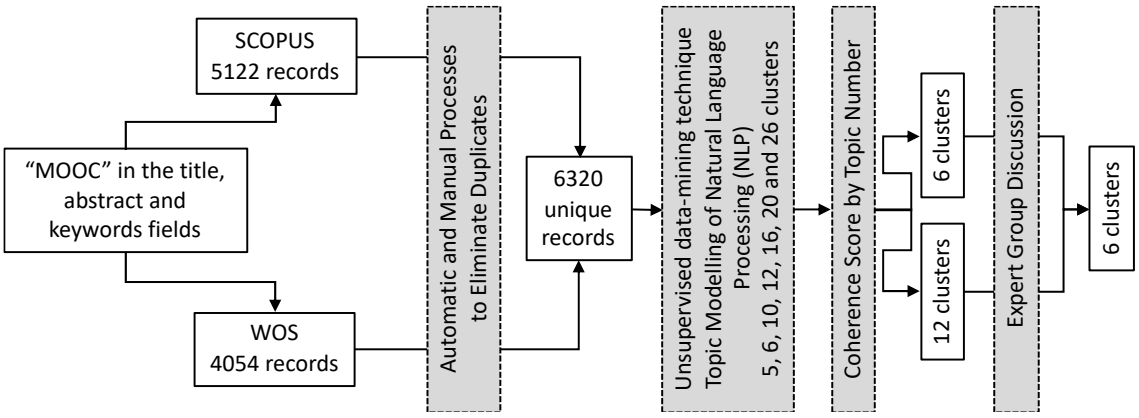
Unsupervised machine learning is a category of ML that includes algorithms that learn patterns from untagged data (Sarker, 2021). Extracting topics is a good unsupervised data-mining technique to discover the underlying relationships between texts, so a technique called Topic Modelling of Natural Language Processing (NLP) was applied. Topic Modelling is a special type of clustering algorithm that makes the clusters dependent on distributing the vocabulary and extracts the characteristics of each cluster, as described by Ahmed et al. (2021). As in some clustering algorithms, these algorithms need the user to specify the number of different clusters to be created. This number can be chosen manually or can be selected using a coherence score technique as explained by Röder et al. (2015). The idea is to calculate the coherence score of the models created with different clusters and select the one with the highest coherence. With these ML algorithms, a list of different groups of articles (thematic clusters), characterized by their most representative words, was created, and each article was assigned to one of these clusters.

With the most relevant divisions made by the ML method, an expert focus group was carried out to select the most meaningful one, according to educational criteria. A Focus group, in this case, a mini-focus group (Scholz, 2001) was introduced in this study to introduce expert knowledge and opinions from a group of key informants (Payne & Payne, 2004).

In this study, focus group participants, based on their expertise, analysed the different divisions made by the ML method and, introducing an abductive reasoning process (Flick, 2017), discussed and consensus on which of them was the best option among the one proposed.

Four academics, experts in Educational Technology and Higher Education (2 male and 2 women), from two different European countries, were invited to an online face to face discussion via Zoom. The four of them received the materials with a short description of the method that was carried on arriving at this point and a brief introduction to what are the next steps to carry out in the process. During the meeting, some questions about the ML process were solved, and the consensus was arrived after 45 minutes.

The whole process followed by the sampling methodology described above is shown in Figure 1.



Artículo V Figure 1. *Sampling Process.*

For the content analysis of the thematic clusters, we used as a method the Visual Network Analysis (VNA), which supports the visualization of the dynamics of networks and their components and focuses on the visual characteristics of networks for a qualitative interpretation (Decuypere, 2019), which differs from Social Network Analysis (SNA) (Wasserman & Faust,

1994), that focuses on the structural social properties of networks. Titles and abstracts were analyzed using the text-mining functionality of VOSViewer 1.6.11 to construct and visualize co-occurrence networks of the most prominent terms from the literature (van Eck & Waltman, 2010), after manually deleting similar and non-significant words through the use of a thesaurus created and iteratively developed by the experts. Considering a manageable and meaningful size so humans can interpret the groups, and after different tests, terms with a threshold of 20 appearances– except from cluster 5, which had less words to show and the threshold was lowered to 15 appearances – were set to be included in the visualization of each group. This should be also acknowledged as a limitation, so for sure terms with less than 20 appearances in each group would not be shown in the visualizations. Out of the number of words corresponding to that condition, VOSViewer calculates a relevance score to show only the 60% most relevant terms – this automatic process differentiates between noun phrases with a general meaning and with a specific meaning (van Eck & Waltman, 2011).

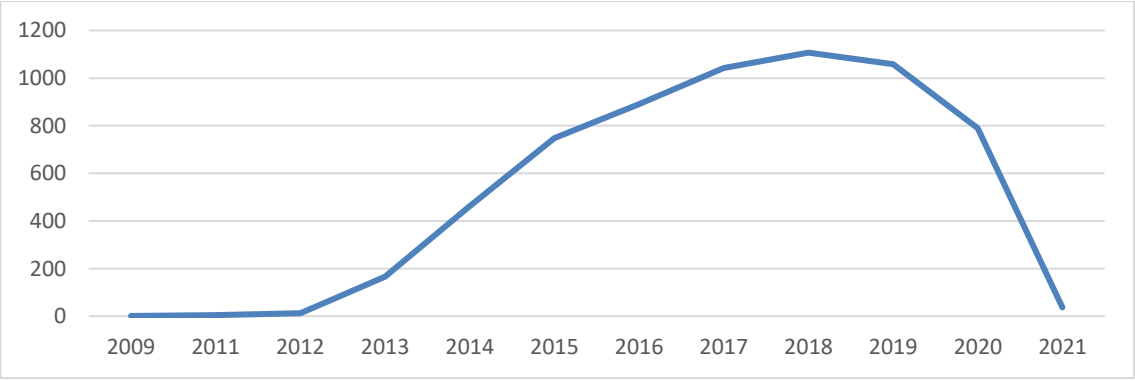
Also, to analyze the clusters' relevance, influence, and impact, we have analyzed the main statistics of the papers on each cluster, using the data provided by the WOS and SCOPUS (e.g., number of citations).

3.2. Results

Our final sample included 5122 records from SCOPUS and 4054 records from WOS. After eliminating duplicates, these records were condensed into a sample of 6320 resources, including papers, conference papers, editorials, etc.

From these 6320 documents, more than a half are conference papers (n=3722, 58.89% of the sample- including long, short and specific papers published in proceedings), a big portion of them are journal papers (n=2282, 36.11%). The lowest numbers correspond to book chapters (n=213, 3.37%) and full books (n=14). There are 74 reviews dedicated to MOOCs during the studied period.

Over the years, distributing the papers shows the evolution of the interest in the topic and the intense hype lived by the topic since 2015, and the stabilization around 2018/2019 (see Figure 2).



Artículo V Figure 2. *Distribution of papers over the years (n=6320)*

The coherence score of the clustering analysis done with one to fifty groups, obtaining figure A1, where the coherences for 6 and 12 groups are the biggest ones, with 6 groups having a slightly higher coherence, as indicated in the title of figure and comparing with the red line drawn to mark the peak coherence (see Appendix A), so 6 groups and 12 groups were selected as the most interesting classifications (see Appendix B). The coherences obtained are the same every time the algorithm is run.

The classification with 6 groups has a slightly higher coherence, but the different with 12 groups is very small. The final decision about the number of clusters to use in the analysis was entirely based on the educational perspective of the 4 experts on e-learning in Higher Education. The relevance of the combination of machine learning and human interpretation with expertise in the

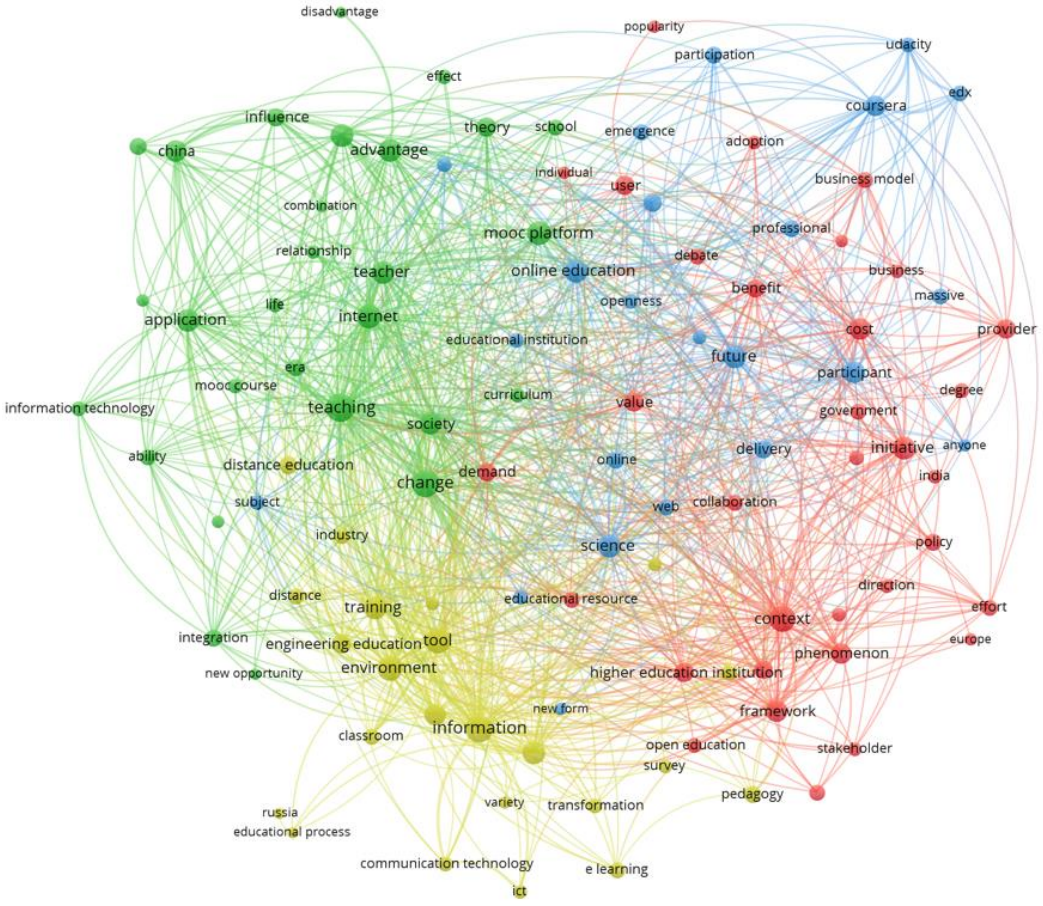
area is essential in order to make sense of the data obtained. They discussed which division of groups would give a more educational approach to analyzing the MOOCs literature. The classification with 6 groups was the one chosen.

A mapping review of each thematic cluster and a comparison between them to understand how they classify the literature is presented below. In this part, two of the four experts worked first individually, to provide a title to each thematic cluster, and then put together their proposal and unified their suggestions; no bigger discrepancies were found out in this process. After this phase, the two experts worked in the description of each cluster and discussed the sub-clusters and interpretations. A clear limitation of this process is the possible differences in interpretations of each of these thematic clusters, which we acknowledge. Visualizations greatly differ from each other, based on the number of publications included in each cluster (more populated), as well as the weight of the terms (the higher the number and strength of links, the more prominent and denser the terms are).

Thematic Cluster 1 – Institutional Approach

This thematic cluster is characterized by the words: *education, university, course, development, technology, platform, institution, quality, country, world, opportunity, paper, challenge, access, MOOC*.

The representation of the network map of this cluster (see Figure 3) has a clear center on *online education* (sub-cluster 3, blue – center-upper part). It shows us a very dispersed interest but with some clear sub-clusters that reinforce the institutional studies and approaches concept.



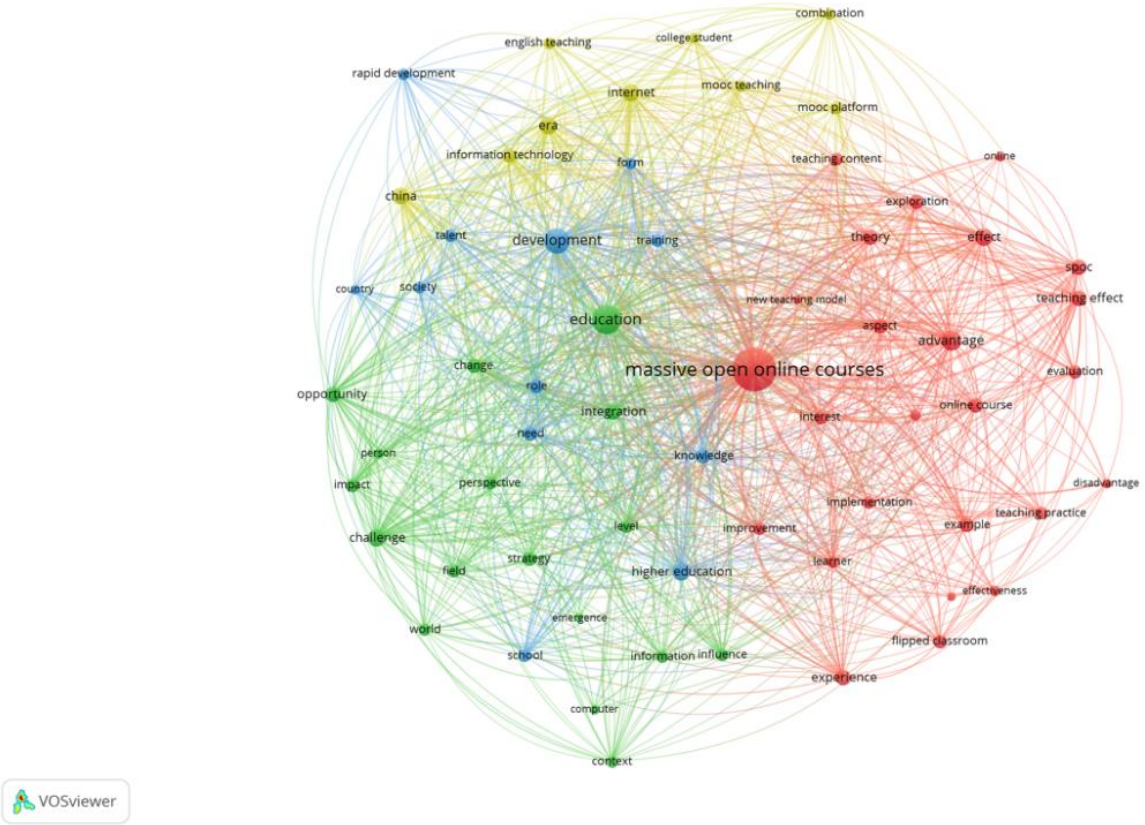
Artículo V Figure 3. *Thematic Cluster Institutional Approaches about MOOCs. Network map.*

Five sub-clusters are identifiable. The red one (sub-cluster 1) combines the business perspective

(with words such as e.g., *business model, benefit, cost, effectiveness, provider*) and the institutional perspective (*policy, government*), with the relevant presence of higher education. Terms that appear are *higher education institution, faculty, policy, government, stakeholder*, but also MOOCs as an online format (e.g., *open educational resources, open education, online learning*). The green one (sub-cluster 2) highlights the relations with education (e.g., *teacher, teaching, curriculum, school*) and a new life context (e.g., *society, life, change, era*). The blue one (sub-cluster 3) focuses on the open format of MOOCs (e.g., *anyone, massive, participant, participation, open access, openness*) and the platforms for delivery (e.g., *coursera, edx, udacity*). Finally, the yellow one (sub-cluster 4) is about the technological means and spaces from an educational perspective (e.g., *environment, tool, educational process, pedagogy*), the relation to *e-learning* and *distance education*, also interesting is the appearance of the term *transformation*. Some continents and countries can be identified in several sub-clusters, which may be key locations for MOOCs from an institutional viewpoint: *Europe* and *India* in sub-cluster 1, *China* in sub-cluster 2 and *Russia* in sub-cluster 4.

Thematic Cluster 2: Pedagogical Approach

This cluster is shaped by the terms: *teaching, mode, college, classroom, reform, model, method, teacher, application, ability, resource, computer, learning, curriculum, and effect* (see Figure 4).



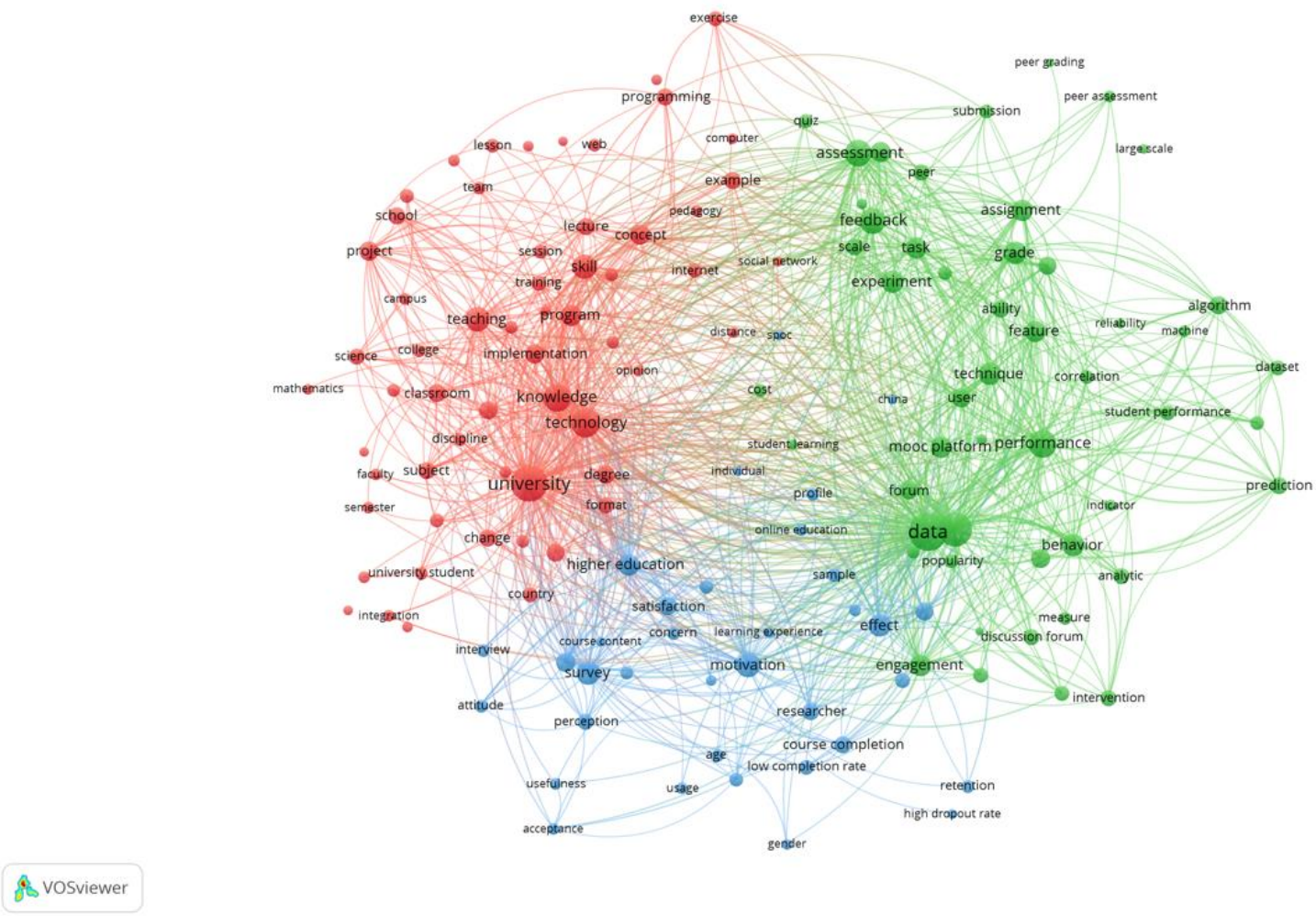
Artículo V Figure 4. *Thematic Cluster Pedagogical Approach of MOOCs. Network map.*

In the network map of this group, there is a clear center: *massive open online courses*, which is part of the sub-cluster 1 (red) from the 4 clear sub-clusters included on the group. The red sub-cluster 1 includes the application of MOOCs in education contexts, especially from a teaching perspective (e.g., *new teaching mode, new teaching model, teaching content, teaching practice, teaching process, teaching effect, learner*). The green one (sub-cluster 2) mentions the possibilities of MOOCs (e.g., *change, emergence, impact, opportunity*), and *education* is prominent. The blue one (sub-cluster 3) addresses the connection of MOOCs between

institutions and professional training (e.g., *development, higher education, rapid development, school, society, talent, training*). The yellow one (sub-cluster 4) is a rather dispersed sub-cluster with words such as *mooc platform, mooc teaching, college student, information technology, internet*, interestingly the term *China* appears, which leads to a guess regarding the importance of MOOCs in that country. All the four sub-clusters remark the pedagogical character of the papers on this group.

Thematic Cluster 3 - Evaluation

Cluster 3 is defined by terms such as *student, course, assessment, performance, study, datum, peer, result, feedback, engagement, group, programming, forum, rate, activity* (see Figure 5)**.**



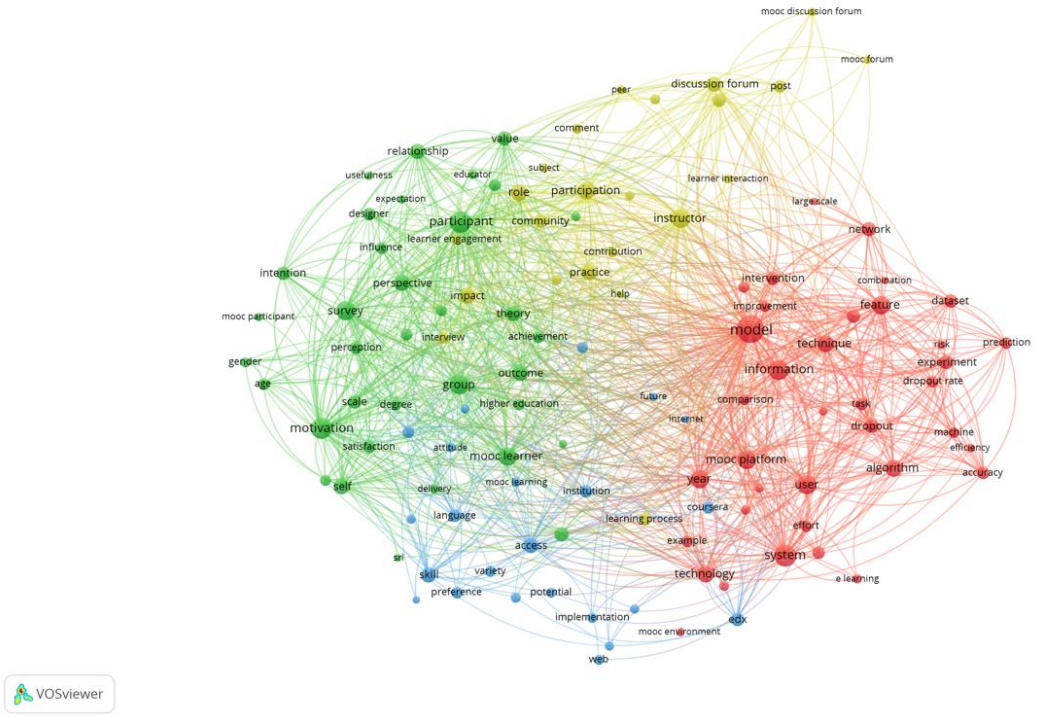
Artículo V Figure 5. *Thematic Cluster Evaluation of MOOCs. Network map.*

On the network representation of this cluster, a focused distribution on three sub-clusters can be identified. However, there is no clear center on it, but instead two preponderant centers: *university* (sub-cluster 1, red) and *data* (sub-cluster 2, green). In the red, sub-cluster 1, more terms are related to university (e.g., *teaching, knowledge, degree, program, lecture, college, classroom*...). *School* is in the periphery, also *programming* is highlighted, and interestingly, *change* appears but not prominently. The green one (sub-cluster 2) includes terms related to the data *sources* and their uses, such as *performance, behavior or engagement*. Other terms are related to the data processes: *algorithm, accuracy, prediction, reliability*. Remarkable terms are related to assessment (upper part): *assessment, feedback, assignment, grade*. In the blue one (sub-cluster 3) the term *higher education* stands out. It shows research done with *survey* (more prominent) and *interview* (lower presence) regarding *perception, attitude, satisfaction, motivation, usefulness, acceptance or usage*. Again, *China* appears in this sub-cluster 3.

Additionally, the relations between the green sub-cluster and the blue one for data, *course*

completion, low completion rate, retention, high dropout rate, effect are very interesting.

Thematic Cluster 4 - AnalyticsThe thematic cluster 4 is shaped by the terms: *learner, course, datum, learning, engagement, study, rate, behavior, forum, self-interaction, completion, dropout, analysis, motivation* (see Figure 6).

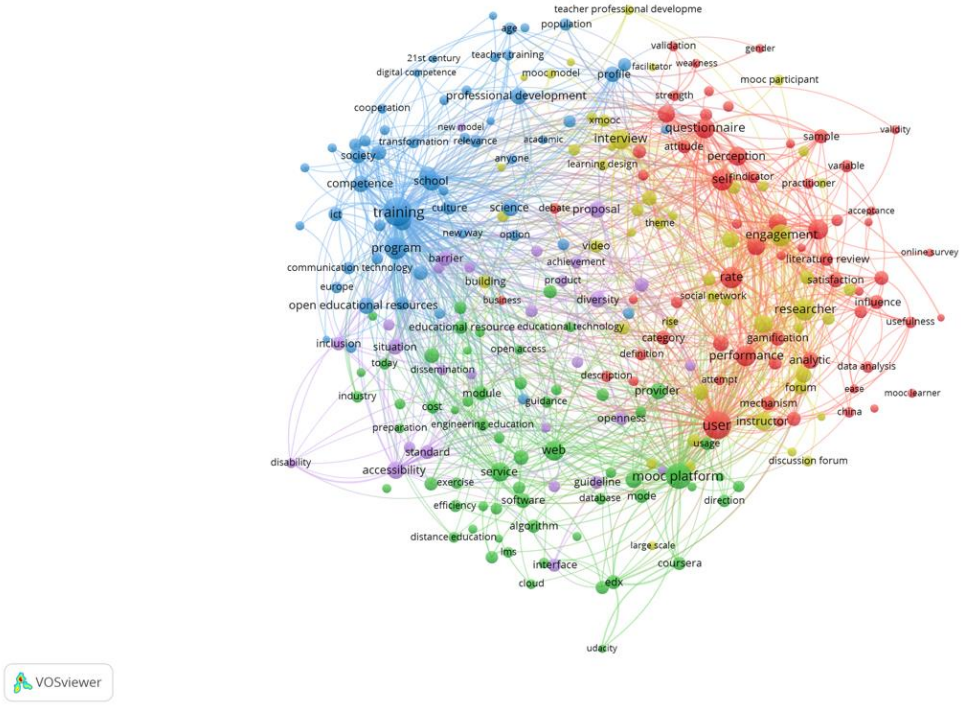


Artículo V Figure 6. *Thematic Cluster Analytics of MOOCs. Network map.*

In this cluster map, there is not a clear center, and 4 sub-clusters have been defined. The red, sub-cluster 1, is about mathematical models to study MOOC large scale data (e.g., *model* (prominent), *information, technique, experiment, algorithm dropout, mooc platform*). The green, sub-cluster 2, shows as prominent elements *participation, perspective, survey, motivation, group, mooc learner and intention*, so it is related to studies on MOOC participants and their motivations to do so. In the blue, sub-cluster 3, it is difficult to clearly identify themes, but it seems related to MOOC implementation and teaching (e.g., *instruction, individual, preference, web*). Finally, in the yellow, sub-cluster 4, the terms consider MOOC activities and tasks: *assignment, course content, forum, participation, pedagogy, learning process*.

Thematic Cluster 5 - Participation

Cluster 4 is defined by: *learning design, teacher, research, study, environment, participant, process, development, tool, approach, experience, framework, project and community* (see Figure 7)**.**



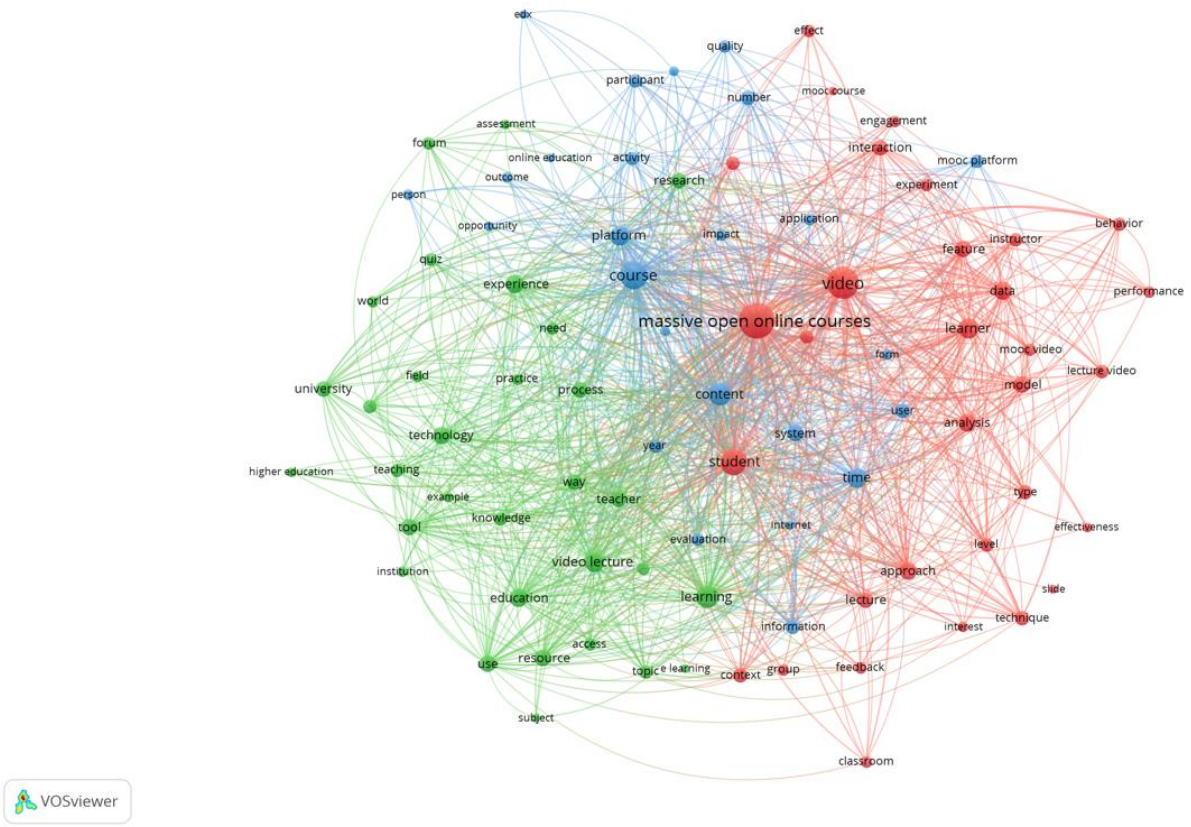
Artículo V Figure 7. *Thematic Cluster Participation on MOOCs. Network map.*

In this cluster, there are no centers; nevertheless, the prominent terms on each sub-cluster provide many clues about the important topics of the papers included.

The yellow, sub-cluster 1, relates to user perceptions regarding MOOCs (e.g., *questionnaire, perception, engagement, performance, user, satisfaction*). The green, sub-cluster 2, may concern the link of MOOCs to prepare for technological training by combining words regarding education (e.g., *educational material, educational process, educational resource, lecturer*), *industry* and *computer science* (e.g., *programming*). In the blue, sub-cluster 3, *training* is prominent and connects to professional training (e.g., *program, professional, competence, open educational resources, professional development, lifelong learning, job, digital competence*). Geographical locations, such as *Mexico, Spain, and Europe,* could reveal the importance of this aspect in those places. The yellow, sub-cluster 4, includes aspects related to learning activity and *engagement* (prominent term) (e.g., *collaborative learning, course design, course material, discussion forum, facilitator, learning activity, learning design, MOOC environment*). Also, *cMOOC*, as a MOOC format with an increased participant engagement, appears. Finally, remarkably, fuchsia, sub-cluster 5, includes two new terms to the analysis: *accessibility and inclusion*.

Thematic Cluster 6 – Educational Resources

The last cluster of papers is defined by the terms: *video, lecture, content, style, user, feature, resource, course, production, quiz, material, time, platform, topic, behavior* (see Figure 8).



Artículo V Figure 8. *Thematic Cluster Educational Resources for MOOCs. Network map.*

In this map, the three sub-clusters are clear. The red, sub-cluster 1, includes the study of the resources, with special emphasis on the *video*, regarding the participants and the learning (e.g., *behavior, effect, effectiveness, engagement, interaction, interest)*. The green, sub-cluster 2, concentrates papers focused on different aspects of teaching and learning in MOOCs, such as *assessment, course, education, higher education, teacher and teaching*. Finally, the blue, sub-cluster 3, is shaped by diverse aspects, such as *course, educational video, online education, quality or impact*.

Cluster Comparison

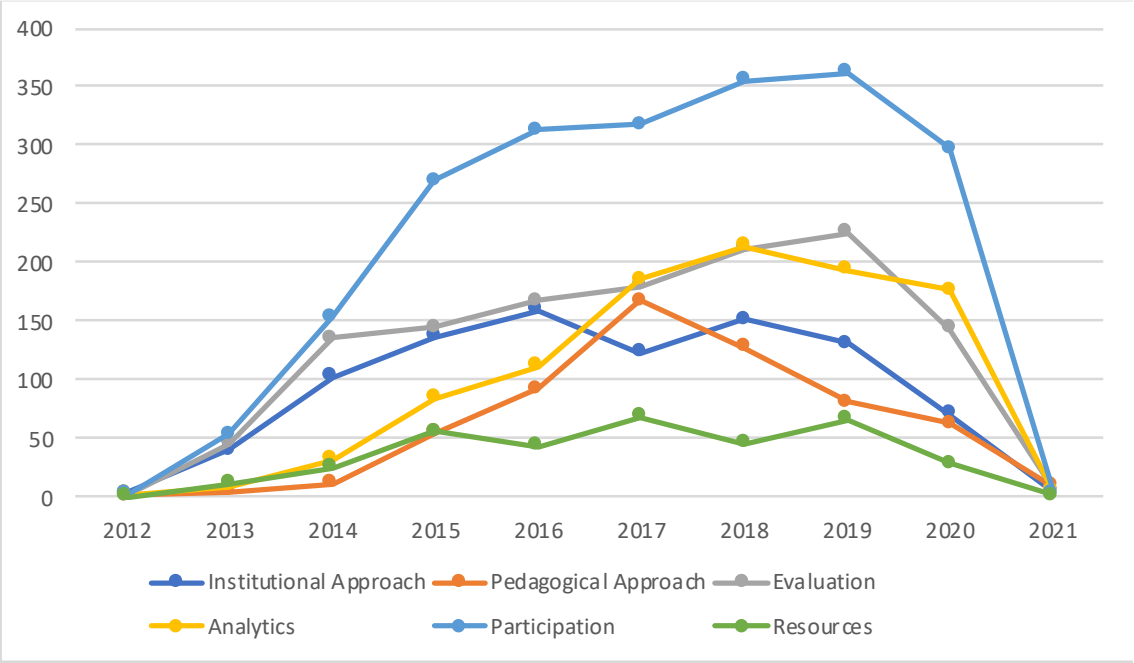
The most popular thematic clusters in the literature about MOOCs are related to participation on MOOCs, representing a third (33.88%) of the literature, and **evaluation,** with a 20.05% of the sample (see Table 2). Remarkably, the less popular topics are those related to the MOOC's **pedagogical approach** -with only 9.73% of publications- and papers related **to resources to implement MOOCs**, with just 5.52% of the literature production.

Artículo V Table 2. *MOOCs literature thematic Groups: production of papers*

	Institutional Approach	Pedagogical Approach	Evaluation	Analytics	Participation	Resources
N	928	615	1267	1020	2141	349
Percentage	14.68	9.73	20.05	16.14	33.88	5.52

Regarding the timeline of the production within each one of the thematic clusters, most have a similar trajectory to the general one. Figure 9 shows how the groups focused on **institutional approaches, evaluation and participation** concentrated the first interests in MOOCs literature until 2014. After 2015, the high growth rate is maintained in the **participation** group until 2019 and, with a much softer slope, in the **evaluation** group. It is important to remark that this analysis is only reliable until 2020, as the query was done in December 2020 (just a few papers from 2021 are included).

The delayed growth of the **analytics and pedagogical approach** groups is worth being considered. With the **pedagogical approach**, it had its peak in 2017, and with the **analytics** cluster, it continues growing until 2018 and then starts to decrease slowly. The **institutional approach** cluster and the one about resources have maintained a regular profile of publication since 2015.



Artículo V Figure 9. *Thematic Cluster temporal sequence.*

From the authors' viewpoint, the other relevant question is how these papers and clusters have influenced the subsequent literature.

Understanding that a paper influences the subsequent literature when it is cited, the influence of each thematic cluster can be analyzed by looking at the percentage of papers of the cluster that have received at least one citation. As seen in Table 3, the most influencing cluster in literature has been the one regarding **analytics,** in which more than a quarter of the produced papers (27.55%) have been cited at least once. In the second place by percentage, we find the **resources** cluster, where 23.78% of papers have been cited at least once. But the cluster with the smaller impact is the **pedagogical approach**, where only 9.27% of the papers have been cited, followed by the **institutional approach.**

Artículo V Table 3. *MOOCs literature thematic Groups: Indicators of subsequent influence.*

		Institutional Approach	Pedagogical Approach	Evaluation	Analytics	Participation	Resources
At least 1 citation in databases	N	140	57	268	281	476	83
	%	15.09	9.27	21.15	27.55	22.23	23.78
Over 100 citations	n	2	0	1	2	2	0
	%	1.43	0	0.37	0.71	0.42	0
Over 50 citations	N	3	0	5	7	5	2
	%	2,14	0	1.87	2.49	1.05	2.41
Over 10 citations	N	37	3	52	56	81	12
	%	26.4	5.17	19.4	23.5	17	14.46
***h*-index**		20	5	21	22	25	11

Looking at the number of citations by paper, the percentage of cited papers that have received over 50 citations in total along these years is very low (in the cluster of **pedagogical approach** is null), and the percentage of cited papers that received over 10 citations in total is still very small.

We can see that the cluster that received more citations by paper in percentage is the one focused on **institutional approach,** where 26.4% of the cited papers were cited over 10 times, followed by the cluster about **analytics** (23.5%). The cluster with fewer citations per paper is the one regarding **pedagogical approach** (5.17%) followed by **resources,** with just 14.46% of cited papers that received over 10 citations in total**.**

If we consider the *h*-index of each cluster, it gets even more interesting. Following the original definition of the *h*-index done by Hirsh (2005), we say that a group has index *h* if *h* of its *Np* papers has at least *h* citations each, and the other *(Np-h*) papers have no more than h citations each. The *h*-index has been considered as a good index to analyze scientific production because it measures the quantity and the impact of a set of literature -in the case of this study, of a thematic cluster- with only one figure (Alonso et al., 2020).

Here, for the less influent clusters (**pedagogical approach** and **resources**), the *h*-index reinforces the results obtained from the percentage of the number of citations. However, for the others, it remarks the importance of the thematic cluster regarding **participation** (the one with the biggest production), as it has the highest *h*-index without having the highest percentage of articles cited over 10 times, what also happens with the **analytics** cluster (with the second highest h-index).

4. Conclusions and discussion

The main goal of this research was analyzing MOOC-related publications since the emergence of the term in the context of education with ML and VNA, offering a complementary and more extensive vision to previous literature reviews on MOOCs, looking at the whole picture of what has been published.

The study has shown the potential of ML and VNA techniques to automatize systematic literature review processes that otherwise would be much more cumbersome processes in terms of time and resources. These techniques are quantitative processes and require human knowledge in the field being analyzed to adequately interpret the results obtained by the automatic procedures. A good example of this was the discussion among experts about which clusters represented better MOOC research and how they could be named.

Concerning RQ1, we identified two divisions in clusters (6 clusters and 12 clusters) based on the coherence score of a range of models. After the expert discussion on the two classifications

based on an educational perspective, the classification in 6 clusters was selected and further analyzed. The 6 clusters in the selected division refer to these topics: institutional approach, pedagogical approach, evaluation, analytics, participation and educational resources.

In the previous literature reviews (see Table 1), only 6 included thematic divisions or a tentative thematic classification of the most important topics on the field (Raffaghelli et al., 2015; Sa'don et al., 2014; Sangrà et al., 2015; Veletsianos & Shepherdson, 2016; Yousef et al., 2014; Zhu et al., 2018).

Out of the 6 clusters in this paper, just two were also identified in the manual reviews. The cluster called "institutional approach", that receives other titles (Business model, Policy and Instructional design, Institutional objectives, Consequences for the higher education system, MOOCs for institutional development, Context and impact, Higher education), but includes the same papers; and the "pedagogical approach" cluster that is identified in them all, also under other denominations (Design, Design for learning in MOOCs, Design focused, Instructional/MOOC design, Learning theories, Pedagogy, Testing pedagogical strategies, MOOC pedagogy). Sometimes, the latter is divided into two clusters (Raffaghelli et al., 2015; Yousef et al., 2014; Zhu et al., 2018). A thematic cluster about Evaluation is included in three reviews (Sa'don et al., 2014; Yousef et al., 2014; Zhu et al., 2018). Only two other reviews included something related to educational resources (Rafagghelli et al., 2015; Sa'don et al., 2014), but in both cases, they are mentioned as "technology" or "technological tools". Only the review carried out by Sangrà et al. (2015) identified a thematic cluster about the use of Learning analytics. Finally, even if the role of social media is understood in some previous reviews as a thematic cluster, the participation (the one in the present review) is not.

After the analysis, we consider that the opportunity of having a first automated approach to the clustering division complemented with an expert educational approach –provided by humans–, helps the review not only to be relevant but also to be coherent from the educational viewpoint.

The RQ2 concerns the internal characterization of each of the 6 clusters. For that purpose, we used VNA and identified thematic subclusters within each topic based on the relationships between terms based on human expertise. This analysis allowed us to confirm the initial topic names/interpretation and supported a deeper understanding of each cluster's studies. Therefore, the combined work between machine and human in this task also gave good results.

In terms of relationships of relevance, impact, and influence between the thematic clusters (RQ3), we can see that the lowest production of MOOC papers is within the topics of pedagogical approach and educational resources, while participation and evaluation papers are the most frequent in the sample. However, the most cited papers are within analytics and resources, being pedagogical approach and institutional approach the ones with fewer citations.

These metrics results, as well as the size and contents of the pedagogical approach cluster, reinforce the absence of topics about education and pedagogy in the papers about educational technology, also pointed out by other authors (Bartolomé, Castañeda & Adell (2018); Zawacki-Richter, Marín, Bond, & Gouverneur (2019)). This situation calls for educators to be involved in the MOOC discussion from a more pedagogical point of view, which also should improve educational practice in an evidence-based way. Also, the need to connect educators working in the field, getting to know what others do - and citing previous work -, would also build upon pedagogical work and give more emphasis on the pedagogical aspect of MOOCs, instead of other topics that are not the core of educational technology.

The percentage of cited papers with over 50 citations – and even 10 citations - is very low for all clusters, and, considering the *h*-index, the order is different for the most cited clusters, as participation (the most popular) and analytics are the ones with the highest *h*-index value and are not the ones with the highest percentage of cited articles. Interestingly, the curve of the evolution of research in the different groups seems to reflect the Gartner hype for technology (Gartner, 2018) and suggests that after the innovation trigger in 2012, MOOC research reached the peak of inflated expectations in 2018-2019. Now it has started a phase that may lead to the trough of disillusionment, before (presumably) reaching the slope of enlightenment. It remains to be seen how the Covid-19 pandemic has affected MOOC research and this curve as in other educational areas (Bond, Marín and Handle, 2021).

Finally, the RQ4 has identified the missing MOOC research. From our findings, there is a clear need for more influential MOOC research from a pedagogical perspective. For instance, there is almost no research regarding pedagogical models and instructional and learning theories applied to MOOCs. Also, there is a strong need to move forward in the research conducted within the topics of participation and pedagogical approach and go beyond aspects that quantify participation. But some aspects are overlooked by the MOOC research, which is focused on the technological aspects. For instance, so far, from the visualizations we have obtained, and taking into account the threshold of words configured in the system, few or null research can be observed that addresses social issues such as digital divide, data privacy, ethics, intercultural aspects or internationalization, which coincides with missing or scarce work and discussion in educational technology around these topics (Kimmons & Rosenberg, 2022).

As a final remark and considering that 74 reviews have been published in the last 10 years about MOOCs, it is time to accumulate and aggregate data to consolidate knowledge about e-learning using meta-analysis techniques. Meta reviews will support the extraction of more robust results and conclusions that inform policy and develop evidence-based practice.

Abbreviations
MOOC Massive Open Online Courses
ML Machine Learning
RQ Research Question
SNA Social Network Analysis
VNA Visual Network Analysis

Availability of data and materials
The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy regulations.

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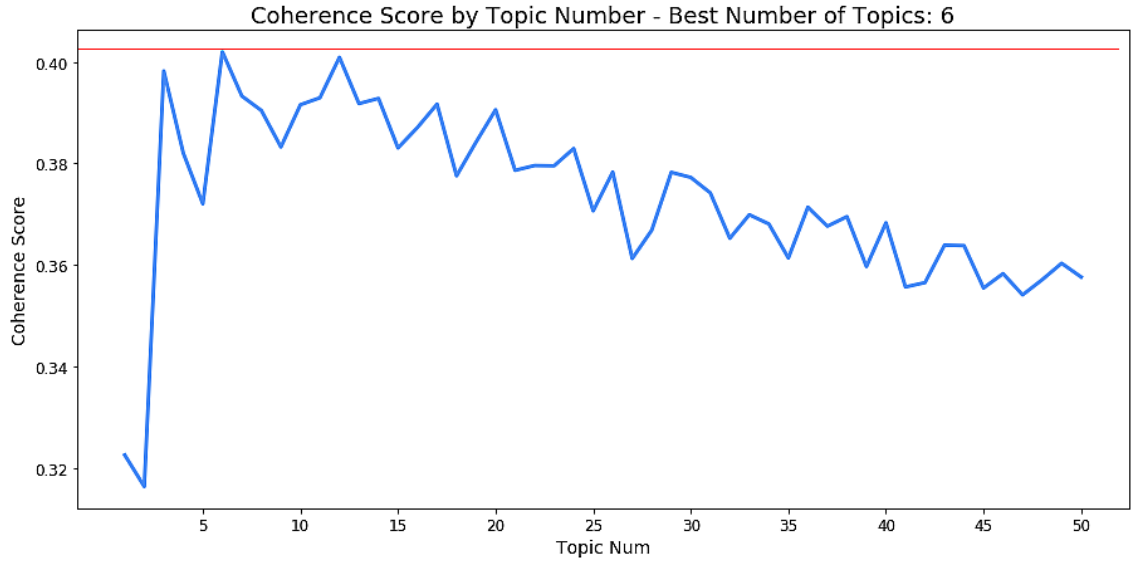
Appendix A. Coherence score of the models

Artículo V Figure A1. *5 to 50 Clusters*



Appendix B. Classifications of six and twelve groups

Six groups:

- Cluster0: education university course development technology platform institution quality country world opportunity paper challenge access MOOC
- Cluster1: teaching mode college classroom reform model method teacher application ability resource computer learning curriculum effect
- Cluster2: student course assessment performance study datum peer result feedback engagement group programming forum rate activity
- Cluster3: learner course datum learning engagement study rate behaviour forum self-interaction completion dropout analysis motivation
- Cluster4: learning design teacher research study environment participant process development tool approach experience framework project community
- Cluster5: video lecture content style user feature resource course production quiz material time platform topic behaviour.

Twelve groups:

- Cluster0: education university technology development institution quality opportunity innovation challenge country world distance access MOOC internet
- Cluster1: teaching mode college classroom reform method application computer curriculum ability resource advantage model effect practice
- Cluster2: student course study group performance engagement result motivation class face completion activity university rate satisfaction
- Cluster3: learner engagement study motivation course completion rate self-behaviour factor interaction activity datum time group
- Cluster4: teacher training development school knowledge project service skill competence face ICT language program experience classroom
- Cluster5: video lecture content style production quiz feature material time topic behaviour text resource concept classroom
- Cluster6: model datum prediction feature dropout behaviour performance method user algorithm analysis analytic research problem rate
- Cluster7: learning environment self-process technology tool strategy knowledge community activity resource face approach experience language
- Cluster8: course platform user content participant paper knowledge experience number resource language web information people tool
- Cluster9: assessment peer feedback evaluation grading quality assignment programming grade review question task approach submission tool
- Cluster10: forum discussion interaction post thread network participant community instructor analysis participation question topic activity content
- Cluster11: design research study framework participant gamification principle project analysis evaluation literature result approach development review

CAPÍTULO 3. METODOLOGÍA DE INVESTIGACIÓN

CONTENIDOS DEL CAPÍTULO

3.1. OBJETIVOS DE INVESTIGACIÓN

El **objetivo general** de esta investigación es estudiar el proceso de diseño desarrollo y mejora progresiva por el cual la Universitat Politècnica de València se ha dotado de la infraestructura necesaria para crear e implementar cursos MOOC.

Teniendo en cuenta este objetivo general que planteamos, entendemos que debe abordarse al menos desde tres perspectivas que constituyen otros tantos objetivos específicos:

1. Estudio del proceso desde el punto de vista técnico/administrativo:
    - 1.1. Documentar el proceso técnico/administrativo que siguió la UPV para poner en marcha la plataforma MOOC
    - 1.2. Analizar pormenorizadamente el proceso de toma de decisiones
    - 1.3. Determinar qué objetivos institucionales se perseguían y cuáles se han conseguido
    - 1.4. Conocer cuál es el grado de satisfacción con los objetivos obtenidos
    - 1.5. Identificar los problemas que quedan por resolver.
2. Estudio del proceso desde el punto de vista del profesorado:
    - 2.1. Conocer la opinión de los profesores y su percepción sobre el proceso
    - 2.2. Conocer los motivos por los que los profesores ofertan cursos en la plataforma, recoger qué objetivos han conseguido y cuál es su grado de satisfacción
    - 2.3. Identificar los focos de mejora percibidos por los docentes que deben ser incorporados en las siguientes actuaciones.
3. Estudio del proceso desde el punto de vista de los estudiantes:
    - 3.1. Describir las características del estudiantado que ha participado en la iniciativa y el uso que han hecho de los MOOC
    - 3.2. Conocer la opinión de los alumnos sobre la iniciativa y los cursos
    - 3.3. Indagar si, tras conocer la iniciativa, están dispuestos a hacer más MOOC en el futuro y a pagar por sus certificados
    - 3.4. Analizar e identificar los focos de mejora identificados por los estudiantes

3.2. MÉTODO Y DISEÑO DE INVESTIGACIÓN

Esta tesis se plantea desde el paradigma de investigación transformador sociocrítico que, como indican Alvarado y García (2008 p. 190), “crítica a la racionalidad instrumental y técnica preconizada por el paradigma positivista y plantea la necesidad de una racionalidad substantiva que incluya los juicios, los valores y los intereses de la sociedad”. Así, como bien indican las autoras, en este trabajo pretendemos unir teoría y práctica y dirigirlas a la transformación del contexto que estudiamos en un modelo que refiere más a la investigación evaluativa.

Somos conscientes de que el tipo de investigación que nos ocupa podría haberse organizado desde la perspectiva de la investigación-acción, pues, atendiendo a las modalidades de investigación-acción propuestas por Grundy (1982), este proyecto puede calificarse como de investigación-acción técnica, al ser un proceso diseñado por técnicos

ajenos a los docentes con un objetivo de creación y mejora de procesos. Sin embargo, somos conscientes de que no hemos llevado a cabo una implementación estricta de los cambios sugeridos en todos los aspectos de la investigación y que eso nos sitúa como investigadores en un plano que no se corresponde directamente con el de investigador-actor. Además, creemos que este tipo de investigaciones podrían asumirse desde propuestas como la de la Investigación Basada en el Diseño, pero entendemos que no es nuestro objetivo estricto generar principios de diseño y que el carácter de las iteraciones en ese tipo de investigaciones no ha sido estrictamente seguido en este trabajo (De Benito & Salinas, 2018).

Aunque el paradigma principal de la tesis es el sociocrítico, el uso de métodos mixtos con aproximación positivista y métodos cualitativos con aproximación interpretativa hace que la tesis se desarrolle en el seno de una estructura paradigmática híbrida que combina elementos de los tres tipos de paradigmas dominantes en la literatura existente (Aristizábal, 2008; Lanuez, Martínez y Pérez, 2008), algo asumido por Kuhn (2004).

Así pues, la tesis se ha planteado como un proceso de Investigación Evaluativa (IE) que busca el análisis de la iniciativa MOOC de la UPV desde diversas perspectivas, dejando un poco de lado el análisis de los objetivos iniciales (Newby, 2010) y que podríamos caracterizar como IE de tipo formativo (MacMillan y Schummaher, 2001), cuyo propósito es aumentar el conocimiento sobre la práctica que se está llevando a cabo y la mejora del programa en sí mismo integrando los puntos de vista de los distintos actores implicados.

La tesis se ha abordado como un estudio de caso, ya que es un enfoque de investigación que permite generar una comprensión profunda y multifacética de un tema complejo en su contexto de la vida real (Crowe et al., 2011). Cada uno de los artículos se ha dedicado a estudiar uno de los aspectos de la iniciativa MOOC (administrativo, profesores, estudiantes y uso durante el confinamiento), tratando una faceta del caso de estudio e intentando conseguir entre todos una visión lo más completa posible del caso estudiado.

Metodología de la revisión de literatura

La parte de la investigación que profundiza en el estado del arte sobre los MOOC se estructura como una revisión sistemática de la literatura, que, según Gough et al. (2017), implica tres actividades clave: identificar la investigación relevante, revisar críticamente los informes de investigación identificados de una manera sistemática que pueda reproducirse y sintetizar los hallazgos de la investigación para guiar a los investigadores en la planificación de estudios futuros. El estudio aplica un enfoque de mapeo o "mapeo sistemático", ya que se centra en describir el campo de investigación en lugar de sintetizar los hallazgos (Newman y Gough, 2019).

REVISIÓN DE LITERATURA

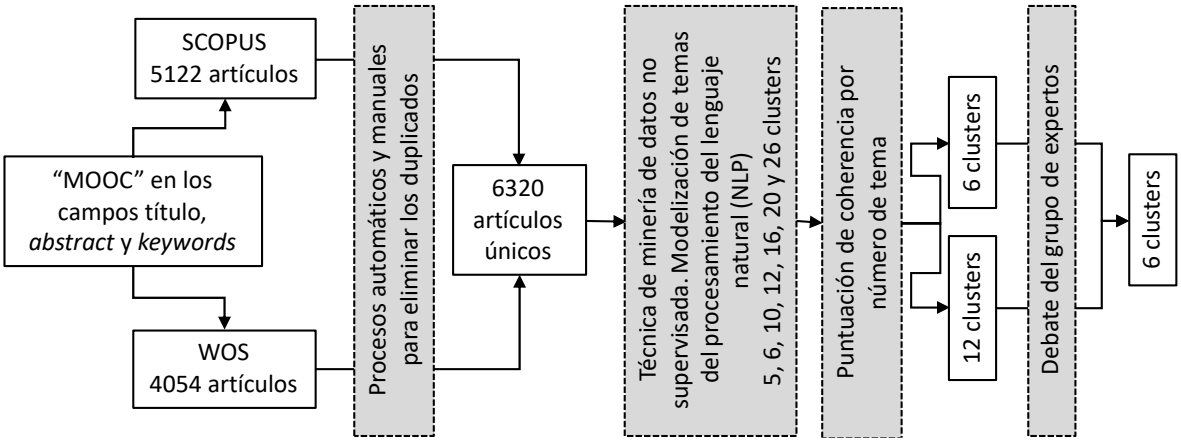


Figura 1. Revisión de literatura sistemática. Metodología específica.

Para recoger la muestra de la revisión de literatura, el primer paso consistió en una simple consulta de la palabra clave "MOOC" en los campos título, resumen y palabras clave en dos de las bases de datos bibliográficas más relevantes del mundo: Web of Science (WOS) y SCOPUS (a 19 de diciembre de 2020). Estas dos bases de datos se consideran las bases de datos de referencia más utilizadas en los campos científico y académico (Archambault et al., 2009) y son confiables para ser consideradas sistemas principales para revisiones sistemáticas (Gusenbauer y Haddaway, 2020).

Los resultados se descargaron en archivos de formato CSV (valores separados por comas) y se unieron en un modelo de datos de Excel, donde se consolidaron en una sola tabla con columnas para el año, el título, el resumen y los autores. Tras realizar un filtrado para eliminar duplicados y realizar una revisión manual de la tabla resultante para detectar duplicados no eliminados y artículos no relevantes, la tabla terminó con 6320 filas.

La particularidad del estudio es el uso de algoritmos de Machine Learning (ML) (machine learning no supervisado) en lugar de identificar manualmente la investigación y revisarla y se ha incluido una comparación con las revisiones de literatura sobre MOOC existentes en el momento para ver si los resultados obtenidos son coincidentes.

Se han utilizado técnicas de aprendizaje automático no supervisado, que es aquel que incluye algoritmos que aprenden patrones a partir de datos no etiquetados (Sarker, 2021). La extracción de temas es una buena técnica de minería de datos no supervisada para descubrir las relaciones subyacentes entre los textos, por lo que se aplicó una técnica llamada Modelado de temas de procesamiento del lenguaje natural (PNL). Topic Modelling es un tipo especial de algoritmo de agrupamiento que hace que los grupos (clústeres) dependan de la distribución del vocabulario y extrae las características de cada clúster, como lo describen Ahmed et al. (2021). Al igual que en algunos algoritmos de agrupación en clústeres, estos algoritmos necesitan que el usuario especifique el número de clústeres diferentes que se crearán. Este número se puede elegir manualmente o se puede seleccionar utilizando una técnica de puntuación de coherencia como lo explican Röder et al. (2015). La idea es calcular la puntuación de coherencia de los modelos creados con diferentes clusters y seleccionar el de mayor coherencia. Con estos algoritmos de ML, se creó una lista de diferentes grupos de artículos (grupos temáticos), caracterizados por sus palabras más representativas, y cada artículo se asignó a uno de estos grupos.

Con las divisiones más relevantes realizadas por el método ML, se llevó a cabo un grupo focal de expertos para seleccionar la más significativa, de acuerdo con criterios educativos. En este estudio se introdujo un grupo focal, en este caso, un mini-grupo focal (Scholz, 2001) para introducir el conocimiento experto y las opiniones de un grupo de informantes clave (Payne y Payne, 2004).

Cuatro académicos, expertos en Tecnología Educativa y Educación Superior (2 hombres y 2 mujeres), de dos países europeos diferentes, fueron invitados a una discusión presencial en línea a través de Zoom. Los cuatro recibieron los materiales con una breve descripción del método que se llevó a cabo al llegar a este punto y una breve introducción a cuáles eran los próximos pasos a llevar a cabo en el proceso. Durante la reunión, se resolvieron algunas preguntas sobre el proceso de ML, y el consenso se llegó después de 45 minutos.

Luego se realizó un análisis de contenido de cada uno de los clusters temáticos obtenidos, utilizando para ello el Visual Network Analysis (VNA), que apoya la visualización de la dinámica de las redes y sus componentes y se centra en las características visuales de las redes para una interpretación cualitativa (Decuypere, 2019), que difiere del Social Network Analysis (SNA) (Wasserman y Faust, 1994), que se centra en las propiedades sociales estructurales de las redes. Los títulos y resúmenes se analizaron utilizando la funcionalidad de minería de texto de VOSViewer 1.6.11 para construir y visualizar redes de co-ocurrencia de los términos más destacados de la literatura (van Eck y Waltman, 2010), después de eliminar manualmente palabras similares y no significativas mediante el uso de un tesauro creado y desarrollado iterativamente por los expertos. Teniendo en cuenta un tamaño manejable y significativo para que los humanos puedan interpretar los grupos, y después de diferentes pruebas, los términos con un umbral de 20 apariciones, excepto el grupo 5, que tenía menos palabras para mostrar y el umbral se redujo a 15 apariciones, se establecieron para ser incluidos en la visualización de cada grupo. Esto también debe reconocerse como una limitación, por lo que los términos seguros con menos de 20 apariciones en cada grupo no se mostrarían en las visualizaciones. A partir del número de palabras correspondientes a esa condición, VOSViewer calcula una puntuación de relevancia para mostrar solo el 60% de los términos más relevantes: este proceso automático diferencia entre frases de sustantivos con un significado general y con un significado específico (van Eck y Waltman, 2011).

Además, para analizar la relevancia, influencia e impacto de los clústeres, se analizaron las principales estadísticas de los artículos sobre cada clúster, utilizando los datos proporcionados por la WOS y SCOPUS (por ejemplo, número de citas).

Metodología del análisis del proceso técnico-administrativo

Para el análisis de la experiencia centrada en el proceso técnico-administrativo llevado a cabo por la universidad, que buscaba analizar los procesos, los productos y la sostenibilidad del proyecto, se realizó una Investigación Evaluativa que se estructuró en ciclos de evaluación, consistentes en el lanzamiento de una edición con diversos cursos MOOC, su ejecución y el estudio posterior del desarrollo de la edición y de los resultados obtenidos para obtener conclusiones de mejora que incorporar al siguiente ciclo.

Cada ciclo de evaluación incluía:

Figura 2. Metodología de ciclos de Evaluación dedicada al proceso administrativo

Para ello, los investigadores siguieron un enfoque de decisión en una investigación de evaluación educativa formativa (MacMillan y Schummaher, 2001), organizado en ciclos iterativos de análisis (seis ciclos de evaluación) en los que las ejecuciones de los MOOC se agruparon por periodo de ejecución y/o plataforma utilizada.

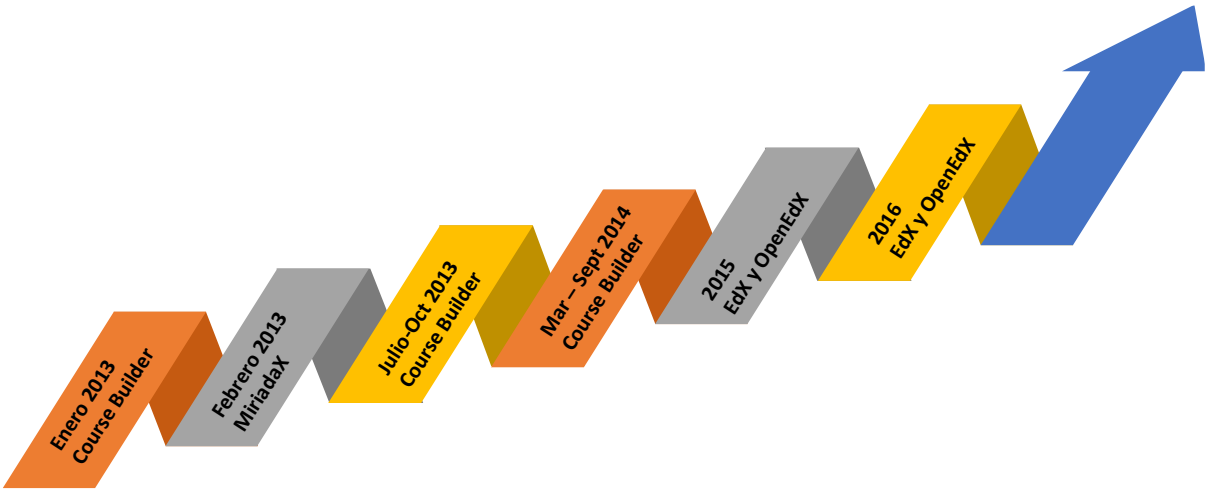


Figura 3 Ciclos Incluidos en el artículo Despujol et al. 2017.

Metodología del análisis del proceso desde el punto de vista de los profesores

Para analizar la experiencia desde el punto de vista de los profesores, la investigación se realizó un estudio evaluativo, pero con un enfoque descriptivo (Cohen et al., 2018). Para obtener información sobre las motivaciones de los instructores, este estudio administró un cuestionario en línea con campos de respuesta abiertos que permitieron a los instructores ampliar sus contribuciones si querían.

Con un enfoque cuantitativo principal pero un complemento cualitativo, este enfoque de método mixto permitió a los investigadores abordar las preguntas de investigación cuantitativa y cualitativamente (Creswell y Creswell, 2018).

El cuestionario se adaptó del cuestionario creado y validado por Young Doo et al. (2020) y recopiló las percepciones de los instructores sobre su motivación para desarrollar MOOC y cómo este trabajo contribuye a su desarrollo profesional. El cuestionario fue modificado para adaptar su contenido a la realidad de la UPV. Las modificaciones fueron: (1) se eliminaron las preguntas sobre el número de MOOC enseñados, sus tipos (dirigidos por un instructor o a su propio ritmo) y el número de inscripciones, porque el equipo de investigación tuvo acceso a la información institucional oficial de la plataforma; (2) se agregó una sección para evaluar la experiencia; (3) en algunas preguntas se incluyó una escala de 0 a 5 para evaluar la importancia relativa de cada ítem; (4) una pregunta fue retirada porque se consideró redundante en el contexto de la UPV; (5) las preguntas se reorganizaron en más secciones para mayor claridad.

El cuestionario consistió en 19 preguntas organizadas en cinco secciones: a) información demográfica y experiencia docente en línea (cuatro preguntas); b) motivación para la enseñanza de MOOC (dos preguntas); c) resultados profesionales e impacto en la enseñanza (tres preguntas), d) capacitación sobre MOOC (5 preguntas) y e) evaluación de la experiencia (5 preguntas).

El cuestionario recogió la siguiente información:

- Información demográfica (edad, sexo, trabajo y experiencia previa con la enseñanza en línea)
- Motivación para la enseñanza de MOOC
    - Tipos de soporte proporcionado
    - Diferentes factores motivacionales y su importancia, con una escala de 0 a 5 para calificar la relevancia de cada ítem
- Resultados profesionales e impacto en la enseñanza
    - Diferentes resultados profesionales obtenidos, con una escala de 0 a 5
    - ¿La enseñanza de MOOC ha afectado su pedagogía? Sí/No
    - ¿Has cambiado la forma en que enseñas otros cursos? Sí/No
- Formación MOOC
    - ¿Has ayudado a otros profesores a comenzar con los MOOC? Sí/No
    - Diferentes formas en que has ayudado a otros profesores, con una escala de 0 a 5 para calificar la relevancia de cada ítem
    - ¿Cuántas horas de formación has recibido?
    - Diferentes formas en que has recibido capacitación, con una escala de 0 a 5 para calificar la relevancia de cada elemento
    - ¿Qué habilidades te gustaría adquirir para mejorar tu enseñanza de MOOC?
- Esfuerzo dedicado y evaluación de la experiencia
    - ¿Vale la pena enseñar un MOOC? (Sí/No)

- ¿Los incentivos monetarios dados por la universidad han influido en tu decisión de crear el MOOC? (Sí/No)
- ¿Los mecanismos de apoyo ofrecidos por la universidad han influido en tu decisión de crear el MOOC? (Sí/No)
- ¿Qué mejorarías en el apoyo que ofrece la universidad? (Abierto)
- ¿Algún otro comentario que quieras añadir? (Abierto)

La versión final del cuestionario fue validada siguiendo el método original de validación. Por lo tanto, la estructura y el contenido del cuestionario se validaron mediante un proceso de validación de contenido y rostro (Holden, 2010) que garantiza la idoneidad y relevancia de los ítems tal como aparecen a las personas que responden al cuestionario (Connell et al., 2018).

Se envió el cuestionario por correo electrónico a los 89 instructores principales de los MOOCs de la UPV (hay más de 100 cursos, pero algunos instructores enseñan en más de un MOOC), y 79 (88,8%) completaron el cuestionario. Aunque se trata de una muestra autoseleccionada, su gran tamaño con respecto a la población debería corregir el sesgo de selección y reforzar los resultados y conclusiones, haciéndolos aún más importantes para ser considerados para toda la institución (Hirschauer et al., 2021).

Los datos cuantitativos fueron analizados desde un enfoque estadístico. Los datos cualitativos (respuestas a las preguntas abiertas del cuestionario) se analizaron utilizando un doble ciclo de codificación, un primer ciclo exploratorio utilizando un método de codificación inicial estructural, seguido de una codificación de patrón para remarcar las categorías que surgieron, y un segundo ciclo de codificación de atribución de contenido, donde las respuestas en cada patrón se codificaron, identificando patrones internos o clasificándolos como positivos. neutro, o negativo (Saldaña, 2015). Dos investigadores realizaron la codificación; cada uno completó un ciclo de codificación.

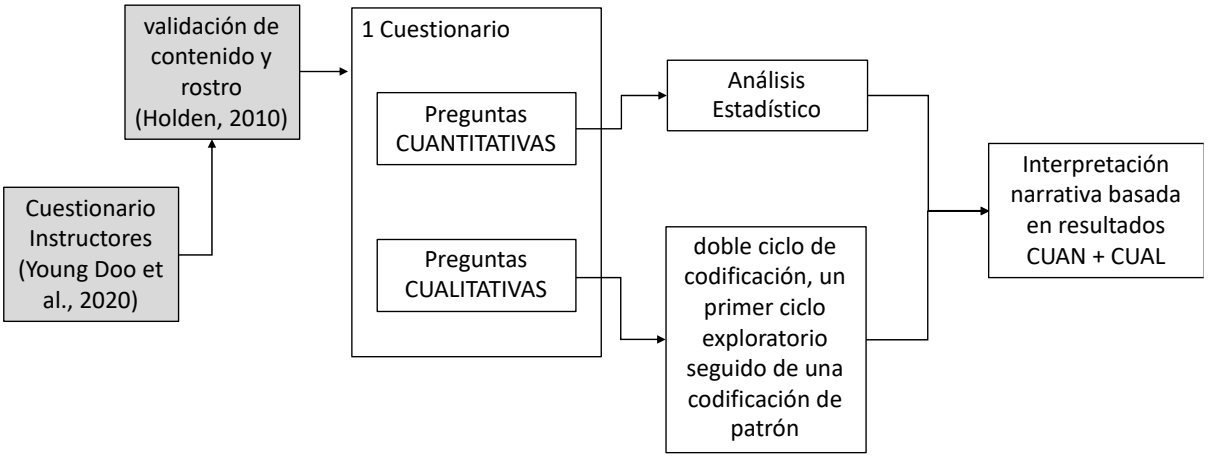


Figura 4 Metodología análisis de la experiencia desde la perspectiva de los instructores

Metodología de los análisis dedicados al uso de los MOOC durante la COVID-19

El estudio del uso que la universidad hizo de los MOOC durante la pandemia también se concretó en dos investigaciones que responden a un modelo de investigación evaluativa con enfoque descriptivo (Cohen et al., 2018). Esto significa que explican y juzgan cómo se produjo la implementación de los MOOCs –evaluándolo–, pero proporcionando un relato narrativo del proceso –con un enfoque descriptivo–, más que comparativo.

Los estudios incluyen la narrativa del equipo que desarrolló la implementación institucional de la experiencia, utilizando tres fuentes de datos en el artículo general: una cuestionario para obtener una descripción detallada de las percepciones de los participantes sobre su experiencia, la base de datos de solicitudes de código, con los correos electrónicos de los usuarios, y el resumen de la analítica de aprendizaje de la iniciativa, proporcionado por edX, para obtener el número total de códigos canjeados y el número total de certificados obtenidos. En el artículo dedicado a las prácticas en empresa se utilizó una cuarta fuente adicional: las bases de datos académicas de la UPV con los resultados de las prácticas.

En el cuestionario anónimo, la información recopilada fue: información demográfica (edad, sexo, lugar de residencia, situación laboral y nivel de estudios), información sobre la iniciativa (nivel de satisfacción de 0 a 5, número de códigos solicitados, número de códigos utilizados, número de certificados obtenidos), información sobre las motivaciones para participar (razones para participar), conocimientos previos sobre MOOCs, uso futuro de los MOOC (intención de inscribirse en otro MOOC en el futuro, disposición a pagar por los certificados MOOC, razones para pagar por los certificados MOOC), información sobre cada MOOC realizado (institución, nombre del MOOC, calidad del 0 al 5, contribución a la carrera profesional de 0 a 5, finalización del MOOC), un campo abierto para comentarios y una pregunta específica sobre si los MOOC les habían dado los conocimientos que habrían adquirido en las prácticas de 0 a 5.

La estructura y el contenido del cuestionario se validaron siguiendo el mismo proceso de validación de contenido y rostro (Holden 2010) que ya habíamos usado en estudios anteriores que exploraban otras perspectivas de este mismo caso y que garantiza la idoneidad y relevancia de los ítems tal como aparecen a las personas que responden a el cuestionario (Connell et al. 2018).

Metodología del análisis de la experiencia desde la perspectiva de los estudiantes

Para la parte de este estudio dedicada a caracterizar a los estudiantes y sus opiniones se siguió la misma aproximación, investigación evaluativa con un enfoque descriptivo.

El estudio incluyó la narrativa del equipo que desarrolló la implementación de la experiencia, utilizándola como base del relato. Sobre ella se incluyeron 2 fuentes de datos: las bases de datos de las plataformas MOOC de la UPV para obtener los datos de demografía (número de inscritos, número de estudiantes que pagan certificados y número de estudiantes que aprueban) puramente cuantitativos, y un cuestionario para obtener una descripción detallada de las percepciones de los participantes sobre su experiencia.

Las preguntas incluidas en el cuestionario fueron:

- ¿Has completado el curso? (sí, no he tenido tiempo, no solo me inscribí para verlo, no me interesaba el contenido, no el nivel del curso era demasiado bajo, no el nivel del curso era demasiado bajo, no los fallos de la plataforma me han hecho abandonar, no la calidad del curso me ha decepcionado).
- En general con el curso: (He aprendido mucho, he aprendido bastante, he aprendido algo, no he aprendido nada)
- A la semana le he dedicado al curso (menos de 1 hora, de 1 a 3 horas, de 3 a 5 horas, de 5 a 7 horas, de 7 a 10 horas, más de 10 horas)
- ¿Cómo ves el nivel del curso con respecto a tus conocimientos previos? (Excesivo, un poco alto, adecuado, demasiado fácil)
- Valora de 0 a 5 si el curso ha satisfecho tus expectativas
- ¿Cómo valoras el sistema de aprendizaje utilizado? (Excelente. Me ha parecido casi perfecto, Regular. Me va a costar mucho trabajo adaptarme a esta forma de aprender, No me ha gustado nada)
- Creo que la velocidad de respuesta de la plataforma ha sido: (Adecuada, algo lenta, muy lenta)
- Para mí utilizar la plataforma (cambiar de unidad, acceder a los exámenes, cambiar de lección o actividad, ver los vídeos, acceder al perfil, etc) ha sido: (Cómodo, Algo incómodo, Engorroso y pesado)
- ¿Has tenido algún problema con la plataforma? (Nada destacable, Salvo pequeños problemas que faltan por pulir ha funcionado bien, He tenido algún problema que se resolvió rápido, He tenido problemas importantes con la plataforma)
- La frecuencia de publicación y el ritmo de aprendizaje del curso me han resultado: (Rápidos, Adecuados, Lentos)
- Las opciones de resolución de dudas me han parecido: (Adecuadas, Suficientes pero lentas, Insuficientes)
- Los exámenes y actividades me han parecido: (Difíciles, Adecuados, Fáciles)
- El contenido de los vídeos me ha parecido: (Excelente, Bueno, Regular, Malo)
- La duración de los vídeos me ha parecido: (Excesiva, Adecuada, Corta)
- ¿Quieres hace algún comentario adicional? (Respuesta abierta

El cuestionario enviado a los alumnos ha sido siempre el mismo, pero con el tiempo ha cambiado la forma de enviarlo al cambiar la mayoría de los cursos de ediciones dirigidas por el profesor (instructor-paced) a ediciones a ritmo del usuario (self-paced).

En las primeras ediciones de upvX y edX y en la de MiriadaX, los cursos estaban abiertos unas pocas semanas o, a lo sumo, uno o dos meses, con lo que las encuestas de satisfacción se mandaban al cerrar los cursos y tenían una tasa de respuesta aceptable.

A partir de 2015 la mayoría de los cursos pasaron a estar abiertos durante todo el año en modo a ritmo del usuario, con lo que no se podía esperar a acabar la edición para mandar las encuestas. Se creó un ciclo de envío de encuestas cada 3 meses que, en muchos casos, y dada la saturación del equipo, llega a ser cada 4 o 5 meses, lo que hace que la encuesta llegue, en muchos casos, a participantes que hace mucho tiempo que han acabado o dejado el curso cuando les llega el cuestionario. Esto, sumando al cambio de política de edX en diciembre de 2018, que hace que un estudiante que no paga pierda acceso al contenido del curso al cumplirse el número de semanas de duración del mismo desde su inscripción, hace que la proporción de respuestas a las encuestas enviadas en las últimas ediciones sea menor.

3.3. CRONOGRAMA DE INVESTIGACIÓN

La investigación de esta Tesis Doctoral ha sido desarrollada durante 8 años y un cuatrimestre, iniciándose en octubre de 2014 hasta julio de 2022. Reflejamos a continuación las actividades sobre las que se ha ido trabajando en cada periodo:

Tabla 2. Cronograma actividades

Octubre 2014 a diciembre de 2015
- Análisis de la realidad y propuesta de tema de investigación. - Planteamiento del problema y las preguntas de investigación - Selección del paradigma y propuesta de metodología de investigación - Revisión de literatura y análisis de antecedentes. - Técnicas e instrumentos de recogida de información - Validación de los instrumentos de recogida de datos - Recogida de datos según el plan previsto - Publicación de resultados y avances de investigación en diferentes jornadas y congresos.
2016
- Primer análisis de los datos recogidos para el primer artículo - Análisis en profundidad de los datos obtenidos - Presentación de la tesis en SIITE 2016 - Redacción del Artículo I - Publicación de resultados y avances de investigación en diferentes jornadas y congresos.
2017
- Redacción del Artículo I - Envío articulo I a revista - Atención a revisiones Artículo I - Publicación de resultados y avances de investigación en diferentes jornadas y congresos.

2018

- Publicación Artículo I (enero)
- Revisión de literatura sobre MOOCs para preparar siguientes artículos
- Publicación de resultados y avances de investigación en diferentes jornadas y congresos

2019

- Revisión de literatura sobre MOOCs para preparar siguientes artículos
- Publicación de resultados y avances de investigación en diferentes jornadas y congresos

2020

- Planificación de emergencia del uso de los MOOC durante la pandemia
- Implementación de acciones durante la pandemia
- Participación en otros artículos relacionados con MOOCs
- Publicación de resultados y avances de investigación en diferentes jornadas y congresos.
- Recogida de datos para el artículo V

2021

- Recopilación de datos para artículos II y III
- Análisis de datos del artículo V
- Redacción del artículo V
- Envío a publicar artículo V
- Análisis de datos artículos II y III
- Redacción artículos II y III
- Envío artículos II y III
- Rechazo artículo V y reenvío a publicar
- Contestar revisiones Artículo II
- Cuestionario de recogida de información artículo de profesores (IV) y validación
- Publicación de resultados y avances de investigación en diferentes jornadas y congresos.

2022

- Publicación Artículo II (enero)
- Contestar revisiones artículo V
- Envío cuestionario Artículo IV a profesores
- Contestar revisiones Artículo III
- Tratamiento de datos Artículo IV y redacción del artículo
- Envío Artículo IV
- Publicación Artículo III (junio)
- Contestar revisiones Artículo IV
- Tratamiento de datos investigación general sobre los alumnos
- Redacción investigación general sobre los alumnos
- Envío a publicar investigación general sobre los alumnos
- Escritura del marco teórico de la tesis
- Aceptación Artículo IV (julio)
- Aceptación artículo V (julio)
- Redacción de la tesis
- Depósito de tesis

CAPÍTULO 4. RESULTADOS

CONTENIDOS DEL CAPÍTULO

4.1. INTRODUCCIÓN

En este capítulo se presenta cada uno de los artículos incluidos en la tesis siguiendo la estructura lógica de los objetivos planteados. Primero se trata el aspecto organizativo en un artículo, luego la satisfacción y opiniones de los profesores en otro y, finalmente, el punto de vista de los alumnos en 2 artículos y una investigación.

Se ha incluido un artículo general que caracteriza a los alumnos de la iniciativa y que todavía no ha sido aceptado, pues se considera que es una aportación importante a la visión general que se quiere ofrecer. El hecho de que el artículo no haya sido aceptado a fecha de redactar este documento hace que su tratamiento sea algo distinto, apareciendo etiquetado como “investigación” en lugar de como artículo.

4.2. RESULTADOS REFERIDOS AL MODELO ORGANIZATIVO

En el primer artículo se presentan los resultados del análisis de la iniciativa desde el punto de vista organizativo, estudiando cada una de las fases del proceso de investigación-acción hasta llegar a un modelo estable.

Con este artículo se cubren todos objetivos específicos del primer objetivo de la tesis:

1. Estudio del proceso desde el punto de vista técnico/administrativo:
    - 1.1. Documentar el proceso técnico/administrativo que siguió la UPV para poner en marcha la plataforma MOOC
    - 1.2. Analizar pormenorizadamente el proceso de toma de decisiones
    - 1.3. Determinar qué objetivos institucionales se perseguían y cuáles se han conseguido
    - 1.4. Conocer cuál es el grado de satisfacción con los objetivos obtenidos
    - 1.5. Identificar los problemas que quedan por resolver.

ARTÍCULO I: “Developing A MOOC Initiative: Lessons Learned from the Universitat Politècnica de València Experience”

Despujol, I., Castañeda, L., y Turro, C. (2018). Developing A MOOC Initiative: Lessons Learned from the Universitat Politècnica de València Experience. Turkish Online Journal of Distance Education, 19(1), 215-233.

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DEVELOPING A MOOC INITIATIVE: LESSONS LEARNT FROM THE UNIVERSITAT POLITECNICA DE VALENCIA EXPERIENCE

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ABSTRACT

Universitat Politecnica de Valencia (UPV) was the European institution with more MOOC course runs done by December 2016. This paper describes and analyses the decision-making process, and rationale of the development of this low budget real MOOC institutional initiative carried out by a traditional higher educational medium sized institution. This analysis is done using an Evaluative Research (ER) method based on an iterative approach of 6 cycles of formative evaluation. It has been a multiple stage process that includes many aspects. In this paper, we will analyze two of them: the creation, organization and management of a fast and cheap MOOC production process, including the several tools, plans, and procedures that have enabled UPV to create courses fast and with a low-cost; and the technical evolution of the initiative, with the different platforms that have been used. As a consequence of this process, UPV has its own platform (upvx.es) based on openedX and is a member of edx.org, with 50 courses, 177 editions, and more than 632.000 enrollments. The completion rate is 8.69%, and post-course surveys reveal a high level of satisfaction from students. The paper will finish addressing the challenges of making this an entirely self-sustainable initiative and reflecting about what is required for evaluating this experience globally.

Keywords: **MOOC, e-learning, Open Universities, higher education initiatives.**

INTRODUCTION

The starting point of the proliferation of systematised experiences of "Massive Online Courses" is always referred to 2008 when Stephen Downes and George Siemens launched their course 'Connectivism and Connective Knowledge/2008' (CCK8) and started to work and learn actively with 2,200 people (Downes, 2009). Not much later, still in 2008, the term Massive Open Online Course (MOOC) was coined by David Cormier and Bryan Alexander to name that experience (Siemens, 2012). However, it was only in late 2011, when Stanford University launched their first experiences on courses as an experiment, that these courses could be called *massive*, as they created three courses that, to their surprise, had enrollments of 100,000 or more students each (Rodriguez, 2012).

That huge success captured the interest of private investors and brought media attention to MOOCs, in such a way that 2012 was called by some media the year of the MOOC (Pappano, 2012). Moreover, as a consequence of all these impressive numbers, many universities around the world started experimenting with MOOC courses. At the end of 2016

-five years after the Stanford experiences, 6850 MOOC had been produced by more than 700 universities all over the world, and more than 58 million students had enrolled in those courses (Shah, 2016).

However, MOOCs are still far from being a consolidated technology-enhanced educational alternative to traditional education. Even when the increasing of research is evident, and the results are promising (Veletsianos & Shepherdson, 2016;), many questions remain to be solved (Margaryan, Bianco & Littlejohn 2015; Rolfe, 2015; Toven-Lindsey, Rhoads, & Lozano 2015, among others). Some of them related to more critical visions on the interpretation of the role of MOOC in the Higher Education portrait (Bulfin, Pangrazio & Selwyn, 2014) and some related to the pedagogical implications of those "massive" teaching models (Bartolome-Pina & Steffens, 2015).

One of these unsolved questions is regarding on how MOOCs are going to become self-sustainable, finding sources of revenue and ways to keep costs low (Conole, 2014; Dhawal Shah 2015; Schuwer et al., 2015). According to Hollands and Tirthali (2014) the cost per MOOC for universities are in the range of $39,000 to $325,000; a cost that agrees with €86,400-€96,000 range mentioned by Elpeboin (2016). This fact makes MOOC initiatives difficult to include in higher education policies (O'Connor, 2014), as well as difficult to justify in a context of economic crisis (Pedreño, Moreno, Ramón & Pernías, 2013).

This paper describes the experience acquired in the process of creating and running a MOOC initiative at a Higher Education institutional level. It includes most of the organisational and technical part of an Evaluation Research process (ER), analysed by cycles of development.

It covers the methodology, results and their interpretations structured by cycles of research, starting with the initial steps taken to launch the MOOC initiative and explaining later the production process that allows the university to develop courses in a fast and cost-efficient way. Afterwards, it treats how the initial platform evaluation was and how the initiative has moved from one platform to other. Moreover, it includes the decision-making process used to introduce improvements during the process.

Even though it is a case study, it is of general interest as it focuses on the analysis of an institutional implementation (UPV is a medium size Spanish public University with around 36000 students), during a period time of 5 complete academic periods (from 2012 to 2016), that explores the different implementation options available in the field and emphasizing in the rationale of the decision-making process. It also presents how to optimise resources, what can be useful for any other Higher Education organization facing the same challenge at this level.

Methods

The main purpose of this paper is to document and evaluate the process that UPV followed to launch the MOOC initiative from the technical/administrative perspective, that includes:

- Documenting the technical/administrative process including platform selection and implementation of specific technological tools, as well as other supporting plans and actions.
- Analyzing the decision-making process
- Identifying the achieved institutional objectives
- Evaluating the level of satisfaction with the achieved objectives
- Identifying problems that remain unresolved

This study, understood as an educational research process (Cohen, Manion & Morrison, 2017) responds to an evaluation research (ER) method, which focuses on the analysis of the process itself, the products, as well as the sustainability of the process, leaving aside some analysis of the initial objectives (Newby, 2010; MacMillan & Schummaher, 2001). The study adopted a qualitative approach of the ER, what means, that the main goal is not to determine

why something works or not, in the program, but understanding how the experience of implementation was, and what results have given under what conditions, along those years.

The UPV MOOC initiative experience has been considered as an intrinsic case study (Creswell, 2007), taking into account that the particular conditions of a Higher Education Institution make it extremely particular, almost unique (politics, locals, history, and so on), but at the same time, its experience would be useful to other institutions that share with this some of their initial conditions. The entire research process concerned to the UPV initiative has been organised in iterative cycles of analysis (six evaluation cycles) where the MOOC runs were grouped by the period of execution and/or platform used. This study includes courses developed from 2012 until 2016.

For the part of the evaluation documented in this work (regarding administrative and technical decisions of the initiative), researchers followed a decision-making approach. On this, the primary focus of research is analyzing the decision-making process historically, in a formative educational evaluation research (MacMillan & Schummaher, 2001), in order to understand better how the process has occurred, in a way that can document the implementation and create knowledge useful in other experiences (Hadley & Mitchell, 1995).

UPV Experience

UPV has been involved in the development of digital video content to support teaching processes for several years, developing a significant experience in the production of video learning objects suitable to the e-learning needs.

As part of this initiative UPV has developed Polimedia, a system to record HD video learning objects using cheap audiovisual studios in a fast and straightforward way (Turro, Cañero & Busquets, 2010); as well as the program “Docencia en Red” that encourages and supports teachers that develop digital learning content and systematically assess its quality (Cáceres& Martínez, 2011). This program has trained more than 600 faculties in creating HQ video learning objects (Despujol, 2014).

UPV has used four different platforms (Google Course Builder, MiriadaX, a customized OpenedX instance called upvx.es and edX.org), has created 50 different courses, of which it has done 177 editions so far with more than 623,000 enrollments and an aggregated completion rate of 8.69% (including courses that do not offer a free certificate) by the end of 2016.

Artículo I Table 1
Basic data about the Evaluation Cycles

Cycle	Edition	Platform	Courses	Registered	Certifications	Rate of completion
1	January 2013	Course Builder	2	1,178	160	13.58
2	February 2013	MiriadaX	14	76,459	11,805	15.44
3	July-October 2013	Course Builder	18	10,083	1,094	10.85
4	March-Sept 2014	Course Builder & Open edX	49	72,207	9,109	12.62
5	2015	edX& Open edX	42	216,236	18,349	8.49
6	2016	edX& Open edX	52	255,937	14,426	5.64
			Total	623,100	54,943	Aggregated 8.69

With this data, at the end of 2016 UPV was the European institution with more MOOC course runs done (Open Education Europa, 2016) and the sixth institution by the number of courses in edx.org with 39 courses, 2 X series and 1 MicroMaster (EdX, 2016).

Additionally, UPV had excellent post survey results, that can be summarized by an average of 4.05 over 5 in the question “Taking everything into account rate how the course has fulfilled your expectations”. Those data come from more than 20,000 answered surveys from course completers and non-completers (a 20% of survey respondents were course non-completers) and reflect that enrolled students are happy with the platform, the courses and the way of learning.

The main question of this research, that is trying to be answered in the paper, is understanding the process of how a traditional face to face university can create a sustainable initiative of MOOC.

Results

First Evaluation Cycle: Need analysis & pilot experience

After the summer of 2012 a year had passed since UPV had uploaded more than 2,000 educational videos to its Youtube and ITunesU channels, and more than 2,000,000 views had been registered, what demonstrated the interest of the public in this type of educational content. On the other hand, MOOCs appeared in mass media as the next educational revolution, and there was only one MOOC developed in Spanish.

The University had the content and the tools (*Polimedia* and *Docencia en Red*) to create MOOCs with little extra effort. In the 2007-2014 UPV strategic plan, there was a strategic line devoted to intensifying the use of IT in teaching (UPV, 2007), and a significant opportunity was detected regarding digital reputation and mass media marketing. Taking all this into account, a group was created to study the feasibility of establishing a MOOC platform.

After studying the literature and state of the art, this group produced an executive report which summarises what a MOOC is, what features it has, how to generate MOOCs at UPV, what the desired characteristics for a MOOC platform would be and what were the platform alternatives available at the time. This information laid the foundations for a pilot phase in the three phases below:

Initial platform evaluation

When the research about MOOC platforms started there were not too many options available: integration in an existing platform (Coursera), installing Google Course Builder (GCB), adapting UPV’s LMS (based in Sakai), using the other Sakai version (OAE) or installing the just launched platform Aprendo/OpenMOOC, an open source platform created for the UNED (Universidad Nacional de Educación a Distancia in Spain) MOOC site. After a first evaluation the conclusions were:

- The visibility and reputation of being a member of Coursera made it an attractive option. Nevertheless, at that moment, they were not accepting more members
- Sakai CLE was not oriented to MOOC. It had all that was necessary, but the interface was not very well suited to MOOC courses. Scalability was a concern.
- Sakai OAE was oriented to easy course creation but lacked several components that are required for a MOOC platform. p.e. Links to Youtube videos had to be manually created as it filtered arbitrary HTML code. The scalability concerns were the same of Sakai.
- OPENMOOC/Aprendo was the MOOC Open source platform used by the Spanish National University of Distance Education UNED in their platform. The student interface was quite similar to Udacity
- Google Course Builder was a script created to host a MOOC in Google App Engine and lacked a teacher interface, but it was very straightforward and easy to understand and modify. It relied on Google's cloud, so it could scale to almost

infinite without any internal IT resources and at a low price (it the traffic is low it is free) (Google, 2016)

The Google Course Builder demo was installed and tried. It worked fine, and the code was simple to understand and modify.

A pilot course with 200 students was run adapting UPV's Sakai CLE deployment. It worked, but the interface was not completely suited to the MOOC experience desired, and scalability was a concern for the future, Sakai OAE was also discarded, so the first version of Google CB was chosen and customised, adding what was found missing with code modifications.

As Google CB did not have a teacher interface, it was decided to pack all the course information in a structured flat file, which at the end was given to the teachers as an Excel spreadsheet. The course data files for Course Builder were created using Excel Visual Basic Macros with this spreadsheet, what later showed as a good choice to be able to migrate courses between different platforms easily.

Definition of the UPV MOOC Model

To define the UPV MOOC model we enrolled as students in several courses offered by Udacity, Coursera and MITx. After studying the structure, content and assessments of the courses offered, and taking into account the experience gathered with our "*Docencia en Red*" programme (Cáceres-González, & Martínez-Naharro, 2011), as well as the infrastructure available, it was decided to develop preferably courses under the xMOOC structure (Daniel, 2012).

The basic features of the structure and characteristics of UPV MOOCs were also set:

- *Structure and workload*: The course had to be structured in modules with clearly independent concepts so that there is a video for each concept. Ideally, a module would correspond to a week's work and involve about 3 hours of student dedication. It was estimated that the module would contain around an hour of video content. This estimation was included as an indication for teachers, not a strict rule, so they could create smaller modules and schedule several of them in a week if they found it appropriate or create modules with more or less video content
- *Videos and written support:* Individual videos should be 1 to 12 minutes long and recorded using the Polimedia technology (teachers could incorporate other videos, but we recommended that the bulk of the course content be created using Polimedia for the speed and economy of production). A downloadable pdf document, with the presentation used in the video or some extended material, should be included for each video
- *Assessment:* After each video, one or more formative assessment questions should be included. These issues should not be part of the final course evaluation. As a standard recommendation, it was stated that at the end of each unit there should be an exam taken into account for the course final mark and a final exam should be included at the end of the course. The recommendation was that these exams were mostly composed of multiple-choice questions, but it was open to adding another type of assessment if the platform supported them. Other number and distribution of exams (a midterm and a final exam, for example) were also possible.
- *Communication & Interaction:* Forums should be included to communicate with students and for them to communicate with each other, supplemented with course announcements that the students saw when accessing the course, and that, in some cases, could be sent by email
- *Access to resources:* The courses should be launched in synchronous editions. Also, to let students access the knowledge between editions, all course

materials, except the final exam, should be available between editions. Therefore, one user could follow the course any time at his or her pace and take the final exam in the next edition of the course to get the digital certificate
- *Certification:* A free non-academic digital certificate in pdf format should be offered to the students that passed the course. This certificate would bear no academic credit (instead of calling it certificate it was called credential to avoid any confusion with continuing education certificates) and should be stored in UPV web servers to be downloaded for authenticity check

Pilot edition

Once the platform was selected, two courses, already created using *Polimedia* format for internal staff training and continuing education, were adapted to make our two first MOOCs.

Artículo I Table 2
Basic data about the First Evaluation Cycle

Cycle	Edition	Platform	Courses	Registered	Certifications
1	January 2013	Course Builder	2	1,178	160

The MOOC team was composed by the platform coordinator, who also acted as course project manager, programmer, and systems engineer and a teaching assistant, that was hired 15 hours per week to help with course review, forum support, final survey, certificate generation and day to day course operations.

The information that was going to be asked to students in pre and post course surveys and how it was going to be retrieved was decided:

- Demographic information when they registered (country, sex, age, level of education and how they knew about the course, of which the only compulsory fields were name, email and country)
- Course and platform satisfaction questions in the post-course survey. As there was no bulk email tool yet, it was decided to use the UPV's instance of LimeSurvey, an Open Source survey tool, and make it compulsory to take the survey to get the certificate, so there were only answers from people who had passed the course

The edition went smoothly, 13.6% of enrolled students passed the courses. The replies to the post-course satisfaction survey, reveal that the courses highly fulfilled the student's expectations, as they were rated it as 4.1 out of 5 in the question devoted to expectation fulfilment (Despujol, Turro, Busquets & Cañero 2014). These results validated the assumptions made about the MOOC format and the feasibility and low cost- of having a MOOC platform based in Google Course Builder running in the Google Cloud.

The upvx.es domain was acquired and redirected to Google cloud platform.

Second Evaluation Cycle: MiriadaX

In November 2012, while preparing the pilot edition, Universia (a Latin-American universities consortium led by Banco de Santander) and Telefonica launched MiriadaX, a MOOC platform for the Spanish speaking universities and a contest to select the best MOOC in Spanish (MiriadaX 2012).

The courses had to start in March 2013, so universities had to prepare them in 3 months. UPV launched a call for proposals for its teachers, and 14 courses were presented (including the 2 of the pilot edition) and prepared.

Article 1 Table 3
Basic data about the Second Evaluation Cycle

Cycle	Edition	Platform	Courses	Registered	Certifications
2	February 2013	MiriadaX	14	76,459	11,805

The satisfaction survey results were good and very similar to the ones of the pilot edition, getting 4.12 out of 5 in the expectations fulfilment question of the post-course survey (Despujol, Turro, Busquets, & Cañero, 2014).

This Evaluation Cycle tested the throughput and speed of the production infrastructure and the scalability of the support group and procedures set to help teachers to create the courses and to facilitate the forum and other course communications.

Using the Excel intermediate format and having a unique team to support all courses together revealed as good solutions. Everything was done with only the platform coordinator and the part-time teaching assistant, even as some scripts had to be developed to export the content to the new format and that the platform was still in a very early stage and some processes were still very cumbersome for the course teams.

It was decided to support teachers in the course creation process as much as they needed, letting them focus on the content creation process. Some teachers created themselves the excel spreadsheet with the course content; others met with the teaching assistant to create it, and others sent the list of videos, the presentations files and word documents with the questions and the team created the spreadsheet of the course.

The bulk email tool (that was lacking in Google Course Builder) revealed as an important tool to remind students about the course as some of them enrolled in the courses and then forgot about the starting date.

As we were not in charge of generating and delivering the certificates the post-course survey was sent to all students.

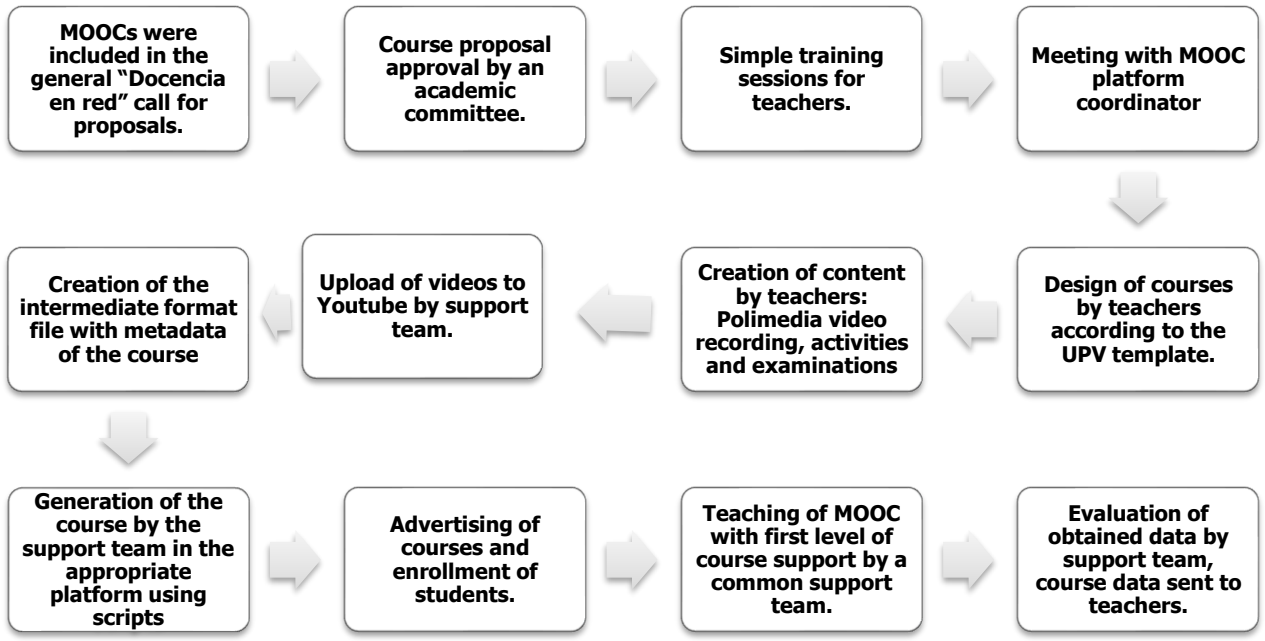
After finishing the edition, MiriadaX changed the economic terms to host MOOC on the platform, and UPV decided to migrate all courses again to Google Course Builder. Having all the courses in an intermediate format gave us much flexibility to migrate between platforms.

To be able to develop 14 courses in three months, the production process was designed around three core principles:

- Using for MOOCs the technology and procedures already in place
- Taking advantage of what teachers wanted to develop, reusing already produced content and creating synergies with other on-campus initiatives if possible
- Keeping things as simple as possible for the teacher

Teachers were encouraged to use Polimedia recording studios to shoot most of the video content of the courses. The main advantages of this are that they produce HD video with high-quality audio being cheaper than a regular TV studio. Additionally, they do not need lighting adjustments, and no editing is required. Consequently, the operation is very simple, so the only staff needed is an operator with very basic training (as the only tasks are placing the wireless microphone on the teacher, checking the audio levels and starting and stopping the recording),.

Moreover, taking advantage of the experience gained in the program *Docencia en Red*, a *Guide for the creation of MOOC* (Cáceres & Martínez, 2014), at this time, a specific process for the selection and implementation of MOOC, was created:



Artículo I Figure 1
General Protocol of Selection & Implementation of MOOC at UPV

With this procedure, any teacher can start working in a MOOC if approved, but the university will not announce the courses until they are almost complete, so there is no problem for the institution if the teacher fails to deliver the course for any reason.

Third Evaluation Cycle: Google Course Builder editions

Google Course Builder was still a code designed to host an individual course, so some modifications were made to its Python code to use it independently to run each course and create a course listing page to make it look like as a common platform. Other modifications were introduced to increase its usability as well as to add new features (as sending emails to students or adding a page with the student progress in the course).

Article 1 Table 4
Basic data about the Third Evaluation Cycle

Cycle	Edition	Platform	Courses	Registered	Certifications
3	July 2013	Course	10	5971	667
	October 2013	Builder	8	4112	427

In the new editions, some manual work was introduced in the process. The digital credentials in pdf had to be created using a semi-manual procedure based on a Microsoft Word Visual Basic Macro. Also, the final surveys were sent personalised (the message was different for the students that had got a credential, including a link to upload the credential to LinkedIn). This extra manual work increased the workload of teaching assistants substantially, so in September 2013 a second teaching assistant was hired.

Artículo I Figure 2
An example of free certificate called “credential."

This Evaluation Cycle demonstrated that a MOOC initiative with several courses could be run smoothly using the modified code from Google Course Builder. Additionally, the cycle highlighted the downside of heavily customising an open source code, as it was impossible to migrate to the newer versions of Google Course Builder without a tremendous effort to port the customised code. The new releases included many improvements (as having several courses in the same application, event recording or aadministration interface) that we were not able to incorporate.

Fourth Evaluation Cycle: Migration to OpenedX

On June 1st, 2013 edX open-sourced its MOOC platform and created an open source community (Fitzgerald M., 2013). The platform offered many features (including peer to peer activities), a consistent teacher interface and a better interface for students and the open source community seemed a guarantee of growth and improvement, so it was decided that it was interesting to try the Open edX platform.

There was an inconvenience, the platform installation script was prepared to be hosted on Amazon servers (that are expensive), and the installation on on-premises university servers was not well documented at that moment. After tweaking the installation scripts, the platform was installed on UPV’s on-premises servers in July 2013, tested and a trial experience was scheduled. Three of the previous courses were selected for the trial experience, one of them as a massive course and the other two because they included peer to peer activities.

It was decided that upvx.es were going to have two general MOOC editions per year, one around March and other around October and a third specific edition in July with only levelling courses for people starting at the University in September. Teachers could decide if they wanted to include their courses in any edition.

Artículo I Table 5
Basic data about the Fourth Evaluation Cycle

Cycle	Edition	Platform	Courses	Registered	Certifications
4	March2014	Course Builder Open edX	14 3	50429	6155
	July 2014	Course Builder Open edX	8	5407	421
	Sept 2014	Course Builder Open edX	9 15	16371	2533

The student satisfaction results were comparable to the ones of former editions (4.2 over 5 for the upvx courses and 4.05 for the OpenEdX ones in the same post-course survey question of previous editions).

In this Evaluation Cycle, the feasibility of using OpenedX to run UPV's platform was confirmed.

After this, UPV decided to move completely into Open edX. As the configuration of the platform out of Amazon servers was not simple, and UPV wanted to be an active member of the Open edX developing community, a developer and a systems engineer were incorporated into the MOOC team at the end of 2013.

After the first Open edX trial edition, and based on the number of enrollments in all courses, several load tests were performed (Despujol, Turro, Orts, & Busquets, 2015) and a hardware configuration was chosen: three web servers, three Mongo DB servers, and two MySQL servers, that was more than enough for the traffic expected. To reduce the impact of teacher's errors two platforms were installed: a production instance with the configuration described above and a test instance where teachers develop courses.

Additionally, two new web tools were also developed to help with the production process: one to import Open edX courses from the Excel intermediate file (instead of using the Visual Basic macro), and other to move MOOC sections between courses in the same or different platforms. Therefore, teachers were able to continue developing a course in the test platform once the course was online in the production instance (Open edX only has the option to import and export entire courses, so once the course is live it is impossible to import new content without affecting the live content). Several Open edX course content components (called Xblocks) were also created (Turro & Salom 2014). The template of the platform (called the "theme") was customised to adapt it to UPV's corporate branding and to add a cookie declaration extension required by EU privacy laws.

Fifth Evaluation Cycle: Joining Edx.org

In November 2014 UPV joined edx.org as a member and this modified the overall MOOC strategy. Joining edx.org was a significant financial effort, but it was considered as an excellent opportunity to increase UPV's digital reputation and to improve relationships with some of the best universities in the world. A tenfold increase in enrollments was also expected.

UPV decided to keep upvx.es to run very local courses and to make the first run of all new courses to see how they worked before running them in edx.org. The home page of upvx.es was modified (using the "theme") to add landing pages for the courses hosted in edx.org (in a way that all the digital marketing effort of UPV could be made announcing upvx.es URLs that routed the web traffic to edx.org). 12 courses were run on upvx.es; some were the local and small courses from previous editions and others the new courses produced, with 17,421 enrollments and a success rate of 20%.

Running the courses on edx.org implied an increased workload for teaching assistants, as all videos have to be uploaded with a text transcription. Even using an own transcription and translation tool called *Translectures* (Silvestre et al., 2012), the transcriptions have to be revised and corrected. The team estimates that one minute of video requires around 3 minutes of work. Taking this into account, as well as the increase in the number of courses, two more teaching assistants (working 15 hours per week) were added to the team in March 2015.

In former upvx.es course editions we had left all course materials, except the final exam, available between editions, so that one user could follow the course any time at his or her pace and take the final exam in the next edition of the course to get the digital credential. In edX, there were two modes of running a course: instructor-paced (with a start and end date and guaranteed support from course team in course forums) and self-paced (open all year

round and without guaranteed forum support). None of them was what we had been doing exactly, so we decided to adapt our model experimenting with one course in a mixed mode.

Artículo I Table 6
Basic data about the Fifth Evaluation Cycle

Cycle	Edition	Platform	Courses	Registered	Certifications
5	2015	edX	30	198,815	14,858
		Open edX	12	17,421	3,491

In February 2015 edX released the second Request of the High School Initiative to finance the preparation of more than 40 college readiness, high school, AP® exam preparation and introductory courses, and, of the seven courses selected in the first batch, two were awarded to UPV: a 16 weeks MOOC, and a series of 5 MOOC interrelated. These six MOOC were launched in September 2015 as self-paced courses and taught in English.

From those six courses produced, “Learn Spanish. Basic Spanish for English speakers BSP101x” was the most successful one regarding student enrollment, gathering 62,435 enrollments in the 16 weeks that it lasts. Nevertheless, its completion rate (around 2%) was much lower than the average completion rate of UPV MOOCs.

Aggregated completion rate of all self-paced MOOCs except the BSP101x was 8.34%, what is 80% of the 10.5% completion rates of the instructor-paced MOOCs of this edition.

All courses in both platforms did very well in the post-course surveys, obtaining similar results to the ones of former editions in the overall satisfaction (4.05/5 for edX and 4.1/5 for upvX). There were no substantial differences in satisfaction between instructor-paced and self-paced MOOCs.

After this Evaluation Cycle the conclusions were:

- keeping our platform to make a first run of the courses and link the courses in edx.org seems a good option to keep digital reputation and maintain independence
- edx.org enrollments for courses in Spanish were, on average, 1.2 to 1.8 range times the ones we got in upvx.es, not the tenfold increase we expected
- The course finishing rate and satisfaction surveys were similar from previous editions.
- The developed tools and procedures worked well for the new environment, and the team of one platform manager, one project/systems engineer, one platform developer, and four teaching assistants were enough to cater for 42 courses with 216,000 enrolled students and contribute to the Open edX community of developers
- Having a developer working in Open edX increases the possibility to experiment and enhance courses and positions UPV as one of the active members of the OpenedX development community
- Self-paced mode implies a 20% to 35% reduction in completion rates and the same satisfaction of students in post-course surveys. The lack of announcements along the year of the self-paced runs translates into a lower monthly enrollment rate
- A combination of one yearly instructor-led (synchronous) edition continued in self-paced mode during the rest of the year is well suited for most of our courses and gives students the chance to access the courses when they need them

Sixth Evaluation Cycle: Self-paced courses and discontinuation of free certificates

We decided to transform most courses to the mixed mode with synchronous start and self-paced continuation. Of the 36 different courses that we run on edx.org, all but three were run in this mode. On upvx.es we run in this mode four of the courses (the three biggest local courses and one of the first runs).

Artículo I Table 7
Basic data about the Sixth Evaluation Cycle

Cycle	Edition	Platform	Courses	Registered	Certifications
6	2016	edX	43	246,110	13,476
		Open edX	8	9,827	950

We compared the enrollment and completion rates of the courses in synchronous mode and self-paced mode, finding that completion rates of most courses fell between 40% and 60% (for two courses it fell more than 80%, and for one course it doubled). Total enrollment numbers were similar for the two modes of running the courses, but the synchronous runs were open for the course duration (several weeks), and self-paced runs were open for the rest of the year (several months).

On January 2016 edX discontinued free certificates for all new courses to increase the amount of paid verified certificates sold, so all our courses but the ones continuing from 2015 (the six courses from High School Initiative) were offered without free certificate option. We compared the aggregated completion rate for 24 of the courses that were offered exactly with the same content than in 2015 (but without free certificate) and it fell from 10.5% to 5.6%. The aggregated verified certification rate increased from 0,7% of the enrollments to 1%, and this increase was not evenly distributed: for career oriented courses verification rates were multiplied by around 2, and for more academic courses the verification rates stayed low (around 0.5%), even descending in some cases.

As most of our courses were offered on edx.org, we also removed the free certificate for courses run on upvx.es.

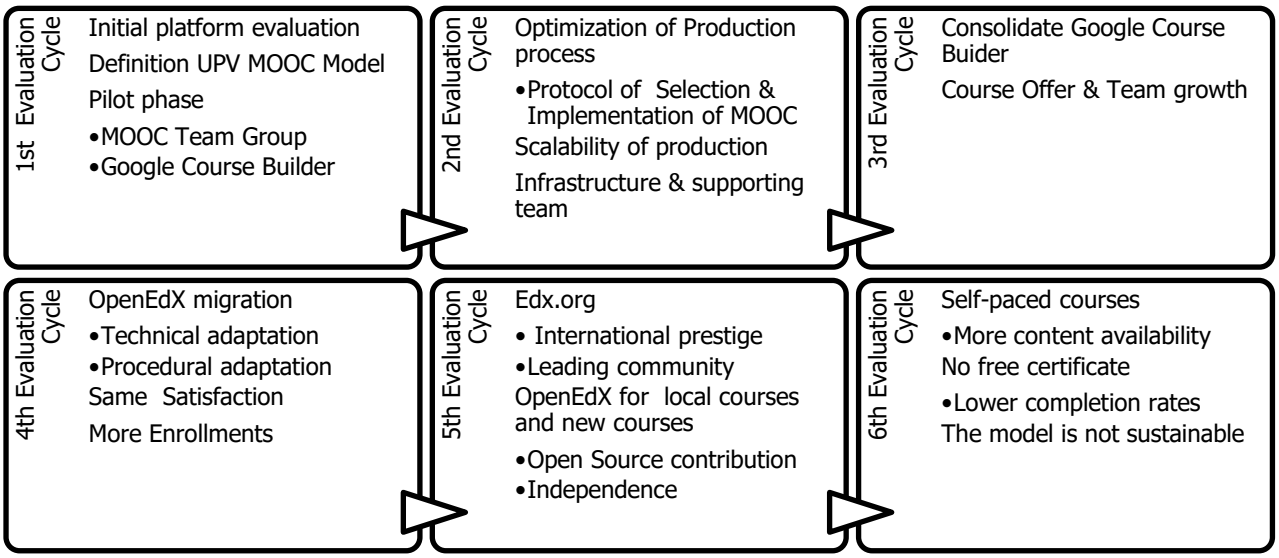
After this Evaluation Cycle the conclusions were:

- The support infrastructure is enough to support the growth in the number of courses and enrollments
- Running the courses in mixed mode (first as synchronous edition and the rest of the year in self-paced mode) maximises access to courses without increasing the workload. There is a significant decrease in completion rates of self-paced mode, but the gains in content availability for students are worth it
- The extended periods of time between announcements of runs in self-paced mode impact negatively the number of enrollments. EdX should devise a way to market self-paced courses periodically
- The lack of a free recognition of achieving the course impacts negatively on the motivation for completion, and lower completion rates. There should be a way to recognise completion that does not compete with paid certificates
- This model is not self-sustainable for the University. With the revenue model of edx.org that charges only for verified certificates to students that demand them and only splits the revenues of a course after a minimum amount has been reached and given the number of enrollments in courses in Spanish and the verification rate (between 0.2 and 3.0% of enrolled students), practically all revenue goes to the platform managers.

Conclusions

Having a research process that tries to describe and analyse the aspects of this institutional implementation, gives us the opportunity of learning from a real context, and reflecting deeply from near the action, but with the huge numbers of an institutional initiative.

The main deliverables from each one of the Evaluation Cycles can be summarised in the following Figure



Artículo I Figure 3
Main deliverables from each Evaluation Cycle

Implications for further implementations

Being a member of edX is a valuable reputation tool and the opportunity to be part of a community that is setting the future of MOOCs. Nevertheless, having an own platform based on OpenedX and tools to migrate content is a good choice to maintain independence and guarantee that the initiative can continue without tying it to a specific external platform (Zancanaro, Nunez & Dominguez, 2017).

UPV has demonstrated that by having a pool of trained and motivated teachers, letting them do the courses they choose and using the right production tools and procedures, a successful MOOC initiative can be run with a marginal cost.

The uniformity of post-course survey results demonstrates that people find the three platforms (Google Course Builder, MiriadaX, and OpenedX) equally satisfactory and that they find this technology suited for learning about a wide variety of subjects that range from traditional civil law and agriculture to Android development or Optical diffraction networks for communications.

The initiative is generating an increasing stream of revenue (around 60,000 $ in 2015 and 90,000 $ in 2016), but it cannot be self-sustainable for UPV with the current income splitting policies of edX. EdX is working to the generation of a new model of revenue generating programmes, Micromasters (edX 2016) and UPV is going to participate in the first edition with one programme, but we believe that a change in the income splitting policy is needed for future contract renewals.

UPV has demonstrated that a full MOOC initiative can be run at low cost, but it is still uncertain if it can generate enough revenue to become self-sustainable. UPV has an ongoing pilot project to offer continuing education certificates for a fee to MOOC completers (after an online

proctored exam) to explore the feasibility of financing the courses this way. The free digital certificate has been retired (following the trend of edx.org, Coursera and the other big platforms) but we are also working in offering a low-cost way of recognising course completion.

Limits and further studies

As it has been previously remarked, this is "just" a case study, and this is just one of the relevant aspects that must be reviewed when studying a MOOC experience.

Implementation of MOOCs in this University, and in every Higher Education Institution, constitutes a significant effort and implies many important things at an incredible variety of levels that must be taken into account. As Liyanagunawardena, Adams & Williams (2013) state and Raffaghelli, Cucchiara, & Persico (2015) and Veletsianos & Shepherdson (2016) confirm, analyzing MOOC implementation implies –or better should imply- the need of understanding multiple perspectives about how they work as well as tackling some still unsolved aspects, such as taking into account the perspectives of all stakeholders, supporting the self-regulation strategies of students to successfully survive those experiences, clarifying the ethical problems with the use of generated data and studying the ineludible pedagogical implications of the implementation of MOOCs. All of them without going in depth into the analysis of the socio-ethical and political- implications of MOOCs (Rolfe, 2015).

In this study the UPV experience has been analysed from the technical and administrative points of view, focusing on the decision-making process and its consequences. We are aware that this is just part of the MOOC implementation experience, a much more complex ecosystem with a lot of different aspects, some of them remarked on the literature as crucial.

The team is aware than a profound pedagogical analysis is required, going beyond the organisational aspects studied here. The very nature of these courses makes it difficult to do a significant one, at least from the educational (didactic) point of view (Bates, 2015), especially if we consider the complex nature of education.

Some efforts are being carried out to understand teacher and student perspectives. In parallel to this work, an analysis of the teaching perspective of the same implementation process is being developed, including teacher workload, satisfaction, needs, and so on, as well as a students' experience study based on the post-course survey answers to gain some insights on the teacher and student experiences, as those remarked in previous works as Yousef & Wosnitza (2014), related to tools and pedagogical strategies used in the courses, El Hmoudova (2014), regarding the use of videos as base of MOOCs (that is the strategy UPV has to follow), and Abber & Miri (2014) regarding the competencies that students need to be successful in MOOCs.

Additionally, the guidelines for quality of “A guide to online learning” and Conole work have been incorporated in training provided to UPV teachers wanting to create a MOOC. We will try to validate the findings of previous research in our future papers and will apply the conclusions to the future courses of the ongoing initiative.

Finally, using the vast amount of data gathered by the platform, the initiative is trying to study how people engage with the content. Devising strategies and procedures to figure out the quality of the learning and improve it is another mostly unexplored field in which the literature is still scarce.

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4.1. RESULTADOS DEL ANÁLISIS DE LA INICIATIVA DESDE EL PUNTO DE VISTA DE LOS PROFESORES

En el segundo artículo se analiza la iniciativa desde el punto de vista de los profesores con un cuestionario contestado por la mayoría de los profesores involucrados que pone de manifiesto sus motivaciones, lo que les satisface de la iniciativa y aquello con lo que no están contentos.

Con él se cubren todos los objetivos específicos del segundo objetivo de la tesis:

2. Estudio del proceso desde el punto de vista del profesorado:

- 2.1. Conocer la opinión de los profesores y su percepción sobre el proceso
- 2.2. Conocer los motivos por los que los profesores ofertan cursos en la plataforma, recoger qué objetivos han conseguido y cuál es su grado de satisfacción
- 2.3. Identificar los focos de mejora percibidos por los docentes que deben ser incorporados en las siguientes actuaciones.

ARTÍCULO IV: "Understanding MOOC instructors' motivations to improve MOOC sustainability"

Despujol, I., Castañeda, L., y Turró, C. (2022). Understanding MOOC instructors' motivations to improve MOOC sustainability. Education in the Knowledge Society. In press

Understanding instructors' motivations to improve MOOC sustainability

Entendiendo las motivaciones de los profesores de los MOOC para mejorar su sostenibilidad

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Understanding MOOC instructors' motivations to improve MOOC sustainability

Entendiendo las motivaciones de los profesores de los MOOC para mejorar su sostenibilidad

The global success of Massive Open Online Courses (MOOC) makes its analysis crucial to guarantee quality, engagement, and best results in their implementation. Much research has been dedicated to understanding learner's experience and institutional results, but few papers have studied the instructor's perspective, which is essential to making MOOC a sustainable endeavour. This study has examined the perceived motivation for participating in a MOOC initiative and the impact on their career development for 79 teachers involved in a university experience that has made more than 600 editions of 115 MOOCs with 4 million enrolments. The study aims at confirming and expanding findings from previous studies and consolidating the institutional strategy regarding resources and dynamics of MOOCs. Main research findings indicate intrinsic motivation factors are essential for MOOC instructors and the lack of official recognition can be a relevant factor affecting MOOCs' long-time sustainability.

El éxito global de los Cursos Online Masivos y Abiertos (MOOC) hace que su análisis sea crucial para garantizar la calidad, el compromiso y los mejores resultados en su implementación. Se han dedicado muchas investigaciones a entender la experiencia del alumno y los resultados institucionales, pero pocos trabajos han estudiado la perspectiva del instructor, que es esencial para hacer de los MOOC un esfuerzo sostenible. Este estudio ha examinado la motivación percibida para participar en una iniciativa MOOC y el impacto en el desarrollo de su carrera en 79 profesores involucrados en una experiencia universitaria que ha realizado más de 600 ediciones de 115 MOOCs con 4 millones de inscritos. El estudio pretende confirmar y ampliar los hallazgos de estudios anteriores y consolidar la estrategia institucional en cuanto a recursos y dinámica de los MOOC. Los principales resultados de la investigación indican que los factores de motivación intrínseca son esenciales para los instructores de los MOOC y que la falta de reconocimiento oficial puede ser un factor relevante que afecta a la sostenibilidad de los MOOC a largo plazo.

Keywords: MOOC, online teaching, e-learning, institutional strategy
Palabras clave: MOOC, educación en línea, estrategia institucional

1-Introduction

Massive Open Online Courses (MOOC), that started with a connectivist based approach, now known as c-MOOC (Lugton, 2012), have reached millions of internet users since they were popularized in late 2011, when Stanford university launched courses with over 100 thousand enrolments each (Rodriguez, 2012) in a format based on video lessons, multiple-choice and numeric exams, and online forums, later called x-MOOC (Lugton, 2012). Although x-MOOC is the dominant format, these two initial formats have given way to a plethora of hybrid formats (Clark, 2013), with some of them (s-MOOC) encouraging the interaction in social networks as an integral tool of the learning process (Brouns et al., 2017), others (ah-MOOC) incorporating adaptative learning (García-Peñalvo, Fidalgo-Blanco & Sein-Echaluce, 2018) and others (t-MOOC) fostering the collaborative creation of new courses by students as the learning tool (Osuna-Acedo, Marta-Lazo & Frau-Meigs, 2018).

Eleven years after this first success, the MOOC movement has expanded every year, with over 19,400 courses from 950 universities worldwide enrolling over 220 million at the end of 2021 -excluding China MOOC providers- (Shah, 2021), and thousands of platforms offering MOOC ranging from global and country platforms to small niche ones (OpenedX, 2018,

OpenedX, 2021).

MOOCs have been the subject of thousands of research papers focused mainly on learners, including their experiences, satisfaction, motivations, interaction patterns, and learning outcomes. There are over 15 literature reviews on the subject (Despujol et al.,2022), ranging from 2013 (e.g., Liyanagunawardena, Adams and Williams, 2013) to more recent times (e.g., Babori, 2020 or Rasheed et al., 2019). However, many questions are still to be answered (Margaryan, Bianco and Littlejohn, 2015; Rolfe, 2015; Toven-Lindsey, Rhoads, & Lozano, 2015, Babori, 2020). MOOCs are still struggling with sustainability (Conole, 2014; Shah, 2016; Schuwer et al., 2015) and low completion rates (Khalil & Ebner, 2014), and there are critical visions about their role in the Higher Education (HE) ecosystem (Bulfin, Pangrazio & Selwyn, 2014) and the pedagogical implications of their "massive" teaching models (Bartolomé-Pina & Steffens, 2015). A small percentage of all this research has focused on MOOC instructors (Blackmon, 2018; Roth, 2013; Kolowich, 2013; Zheng et al., 2016; Blackmon, 2018; Gonçalves& Gonçalves 2019) and a small fraction on how MOOC development impacts MOOC instructors on their motivation and career development (Kolowich, 2013; Lowenthal et al., 2018; Young Doo et al., 2020).

Considerable time and effort are required to design and develop MOOC (Zhu et al., 2018), and the courses are offered for free or for a minimal fee, so understanding the motivations and frustrations of instructors developing MOOC is important for the long-term sustainability of the initiative.

Several previous studies highlight that MOOC instructors are primarily driven by intrinsic rather than extrinsic incentives (Lowenthal et al., 2018; Najafi et al., 2015). These motivations include an instructor's passion for teaching their subject of expertise, a desire to foster innovations in teaching and learning, and the belief that MOOCs are a good tool to promote educational equality (Hew & Cheung, 2014; Lowenthal et al., 2018). Extrinsic incentives include the opportunity to increase publicity and influence (Kolowich, 2013; Lowenthal et al., 2018) and promote (Hew & Cheung, 2014). All these studies conclude that instructors think teaching MOOCs is worth it.

Nevertheless, studies also indicate that instructors often lack adequate professional preparation in online teaching (Zhu et al., 2018). Number of enrolments, different expectations, personal circumstances of learners (some who don't intend to finish the courses) (Hew & Cheung, 2014), distance, and the use of a technological platform make them a very different knowledge construction and transmission environment from traditional classrooms (Ross et al., 2014).

This study extends the research made by Young Doo et al. (2020), which, in a non-randomized sample of instructors (149) from the English-speaking global community, explored what benefits they perceive and the problems that frustrate them when they develop a MOOC. This paper incorporates the views of the entire community of instructors of Universitat Politècnica de València (UPV) –with a representative sample (88.88% of the total population)– that created MOOC in Spanish. This study explores their motivations and examines the knowledge and skill areas they think need to be reinforced for teaching MOOC more effectively in their institution and localizing these results in a precise context that makes their conclusions concrete contributions to institutional development that can be transferred to other contexts.

As UPV, many universities are integrating the MOOC as a part of their approach to digital education, so understanding the motivation of one of the key actors is crucial for them. Our ambition is to continue creating an ecological perspective of the institutional strategic digital education development of MOOC after the analysis of the management of the initiative (Despujol et al., 2018)), the curriculum development (Despujol et al., 2022), and their influence on other levels of education (Llorente-Ruiz et al., 2021).

2-Materials and methods

The study's primary goal is to get an insight into the motivations and concerns of the MOOC instructors/developers from an HE institution's community – in this case, the one configured by the Universitat Politècnica de València (UPV)–, analyzing their motivations and how the initiative impacts their career development, and how this is related to the institutional strategic digital education development.

This study formulates the following research questions:

RQ 1: What motivates UPV instructors to teach MOOCs and what support have they received from the institution?

RQ 2: What outcomes have UPV instructors gotten from teaching MOOCs?

RQ3: How do MOOC instructors get their training to create and deploy MOOCs?

RQ4: What aspects of the MOOC process do UPV instructors think can be improved and how?

RQ5: Are instructors satisfied with their MOOC experience?

The exploration has been structured as a case study, as it is a research approach to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context (Crowe et al., 2011). This study case is considered evaluative but with a descriptive approach (Cohen et al., 2018). To get insight into instructor motivations, this study administered an online survey, developed and validated in Young Doo et al. (2020), with open response fields that let instructors extend their contributions if they wanted.

With a principal quantitative focus but a qualitative complement, this mixed-method approach has enabled the researchers to approach the research questions quantitatively and qualitatively (Creswell & Creswell, 2018). Quantitative data has been analyzed from a statistical approach. Qualitative data (responses to the open-ended survey questions) were analyzed using a double cycle of coding, a first exploratory cycle using a structural initial coding method, followed by a pattern coding to remark the categories that emerge, and a second cycle of content-attribution coding, where the answers on each pattern were attribute coded, identifying internal patterns or classifying them as positive, neutral, or negative (Saldaña,2015). Two researchers performed the coding; each completed one cycle of coding.

2-1-Survey

The survey was adapted from the survey created and validated by Young Doo et al. (2020) and collected instructors' perceptions of their motivation to develop MOOC and how this work contributes to their career development. The survey has been modified to localize its results, adapting its content to UPV's reality. The modifications were: (1) questions about the number of MOOCs taught, their types (instructor-led or self-paced), and the number of enrolments retired because the research team had access to the official institutional information from the platform; (2) a section to evaluate the experience was added; (3) a scale from 0 to 5 to evaluate the relative importance of each item was included in some questions asked; (4) one question was retired because it was considered redundant in the context of UPV; (5) questions were reorganized in more sections for clarity.

The survey consisted of 19 questions organized into five sections:(a) demographic information and online teaching experience (four questions); (b) motivation for teaching MOOC (two questions); (c) career outcomes and impact on teaching (three questions), (d) MOOC Training (5 questions) (e) evaluation of the experience (5 questions). (See Appendix).

The survey included the collection of:

- Demographic information (age, gender, job, and previous experience with online teaching)
- Motivation for teaching
    - Types of support provided
    - Different motivational factors and their importance, with a scale from 0 to 5 for rating the relevance of each item
- Career outcomes and impact on teaching
    - Different career outcomes obtained, with a scale from 0 to 5
    - Has MOOC teaching affected your pedagogy? Yes/No
    - Have you changed the way you teach other courses? Yes/No
- MOOC training
    - Have you helped other teachers to start with MOOCs? Yes/No
    - Different ways you have helped other teachers, with a scale from 0 to 5 for rating the relevance of each item
    - How many hours of training have you received?
    - Different ways you have received training, with a scale from 0 to 5 for rating relevance of each item
    - Which skills would you like to gain to improve your MOOC teaching?
- Efforts devoted and evaluation of the experience
    - Is it worth teaching a MOOC? (Yes/No)
    - Have the monetary incentives given by the university influenced your decision to create the MOOC? (Yes/No)
    - Have the support mechanisms offered by the university influenced your decision to create the MOOC? (Yes/No)
    - What would you improve in the support offered by the university? (Open-ended)
    - Any other comments you want to add? (Open-ended)

The final version of the survey has been validated following the original method of validation. Therefore, the structure and content of the survey were validated using a content and face validation (Holden, 2010) process that guarantee the appropriateness and relevance of the items as they appear to the persons answering the survey (Connell et al., 2018).

2-2-Study Context

UPV is a mid-sized public Spanish university (UPV, 2021a) that is the leader of the Spanish-speaking MOOC offer, with over 100 courses and 3.5 million enrolments on edX at

the moment of writing this paper (edx, 2022). UPV launched its own MOOC initiative in 2013 and, since then, has been using MOOC as one of its strategic levers for digital transformation (Despujol et al., 2018). UPV started with its own MOOC platform (upvx.es, which is still in use today), participated in miriadaX.net (a Spanish speaking MOOC platform), and joined the edX.org at the end of 2014, launching over 600 editions of 115 MOOCs –most of them in Spanish– with almost 4 million enrolments (Despujol et al., 2022).

UPV is open to any of its faculty or staff proposing the creation of a MOOC. A commission approves the new MOOC proposals, and once they are approved, the instructors are directed to the MOOC department. There is a yearly program to incentivize the creation of digital learning materials that gives faculty a little money and academic points if they present their MOOC (UPV, 2021b). The program also provides academic points for MOOC supervision each time a new run is launched.

In a few cases, the university gave course release time for the MOOC creation to the instructors that created university entry-level MOOC for new university students (Llorente-Ruiz et al. 2021), and in others, instructors got financing from edx.org for preparing specific MOOC demanded by institutional customers. Nevertheless, most developers create their MOOCs without knowing if they will get any income from them (the University splits the revenue from edx.org via the certificate fees, and a few UPV MOOCs have been successful in revenue generation, but most are not producing earnings for the instructors).

UPV has a specific department to help instructors develop and run MOOCs, with a set of processes that lets them choose between focusing only on content design and development and participating in the design of the courses as much as they want (Despujol et al. 2018; Turro et al., 2010).

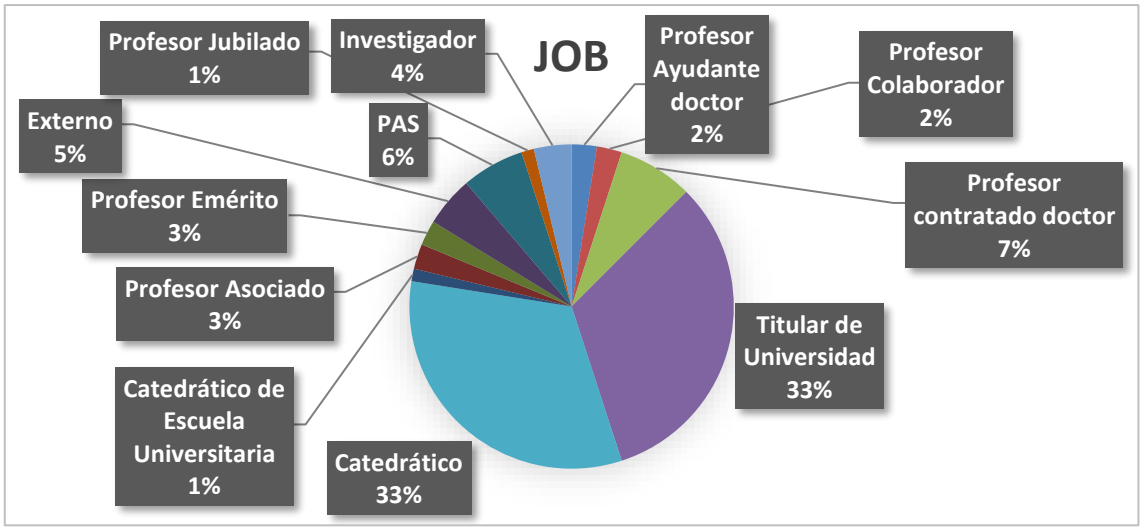
The MOOC team has created a SPOC (Small Private Online Course) to train MOOC instructors that is always open as a self-paced course (https://upvx.es/courses/POC/creaciondeMOOC/2015-01/about), and two synchronous runs are launched per year. A pdf guide for MOOC instructors has also been created.

UPV has a common team of teaching assistants that attends the forums of all running courses, scanning the questions and sending them to MOOC instructors only when necessary, so all instructors can rely on them when managing the forum of their MOOC.

2-3-Participants

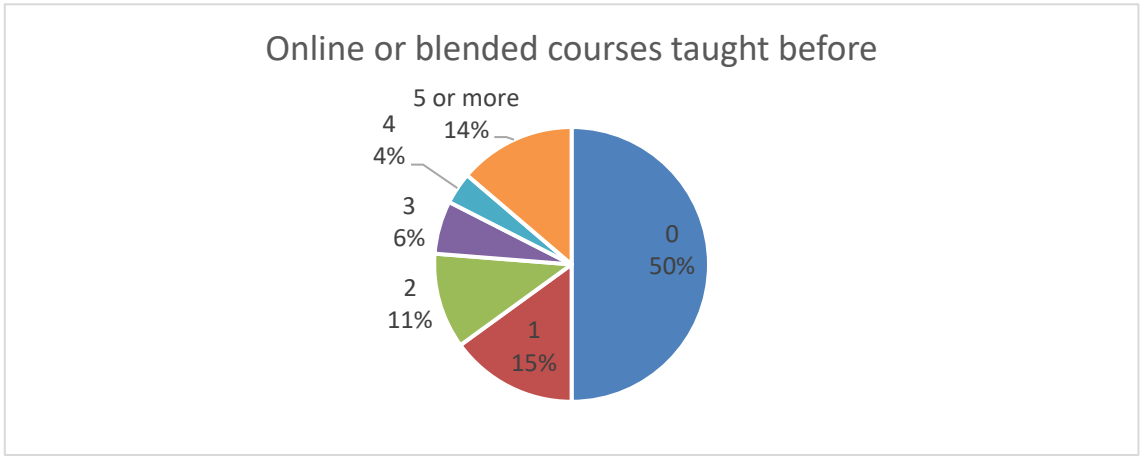
A Web-based survey was sent by email to the 89 main instructors of UPV's MOOCs (there are over 100 courses, but some instructors teach in more than one MOOC), and 79 (88.8%) completed the survey. Even if this is a self-selected sample, its big size regarding the population should correct the selection bias and reinforce the results and conclusions, making them even more important to be considered for the entire institution (Hirschauer et al., 2021). In terms of the gender of the participants, 50 identify themselves as male (63.3%) and as 29 female (36.7%). Their ages varied between 25 and 79 years old, with an average 51.5 years. Most instructors in the sample work for UPV either as faculty, researchers, or technical staff (Figure 1). 83% were faculty, with most being full professors (33%), called Catedráticos, or associate professors (33%), called Titulares de Universidad, 6% were technical staff (identified in figure 2 as PAS) and 4% were researchers (identified in figure 2 as Investigador).

There was a retired faculty (identified in figure 2 as Profesor jubilado), 2 emeritus professors, and 5% were external collaborators. The rest of faculty positions (Profesor contratado doctor, Profesor ayudante doctor, Profesor colaborador, Catedrático de escuela universitaria and Profesor Asociado) are difficult to translate to other university systems outside of Spain.



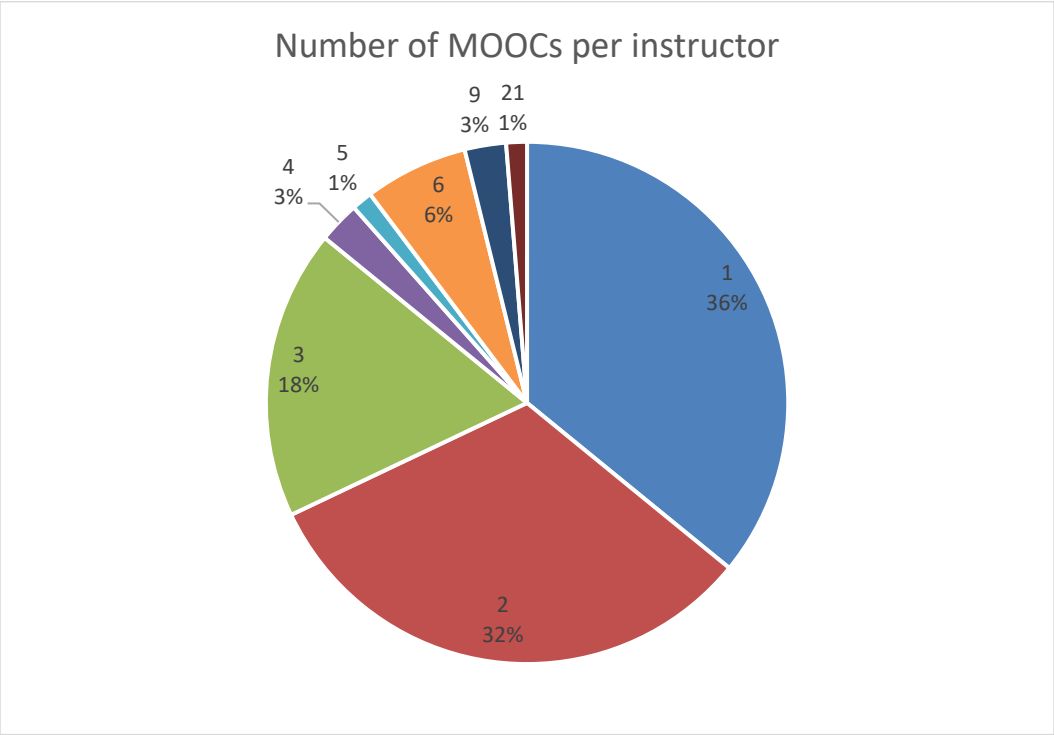
Artículo IV Figure 1: Position of MOOC instructors

Half of the sample had never participated in an online or blended course, and 5% had participated in 5 or more (Figure 2).



Artículo IV Figure 2: Online or blended courses taught before

As for the number of MOOCs developed, most participants had developed one (36%) or two (32%) MOOCs, with 11% having developed 5 or more MOOCs (Figure 3).



Artículo IV Figure 3: Number of MOOC taught

Most MOOCs had been run several times (the average number of runs per course was 5, with a maximum of 15 runs and a minimum of 1), usually starting with an instructor-led run and following with self-paced runs, so all instructors had experience with both types of MOOC delivery.

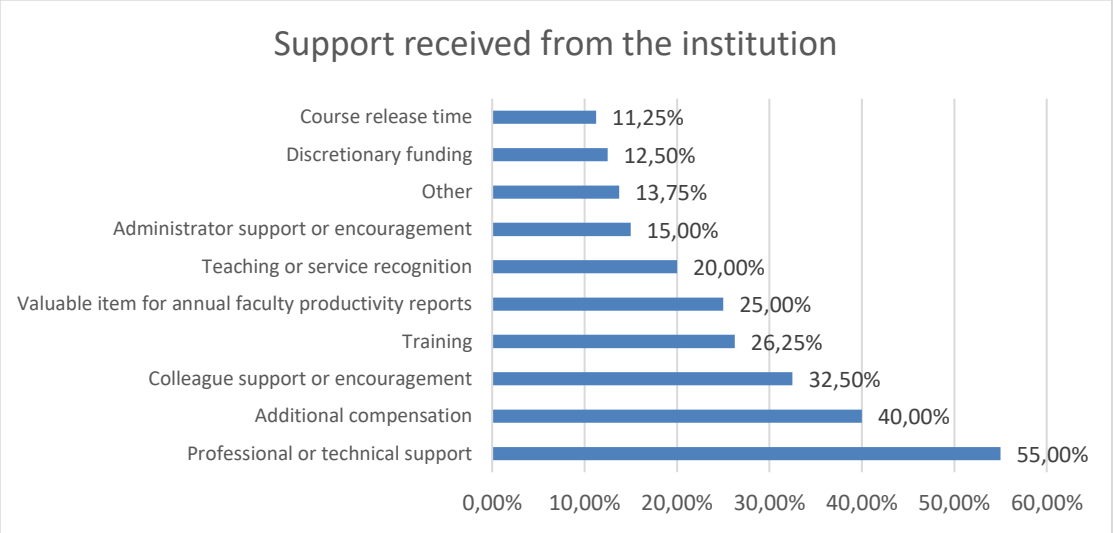
The instructor participating in this study had created 122 MOOCs, of which 616 runs had been delivered since January 2013. The average enrolment in a MOOC run was around 7,000, with a maximum of 160,000 enrolments and a few runs of some MOOC with a few tens.

3-Results

This section has organised data and results using the Research Questions order.

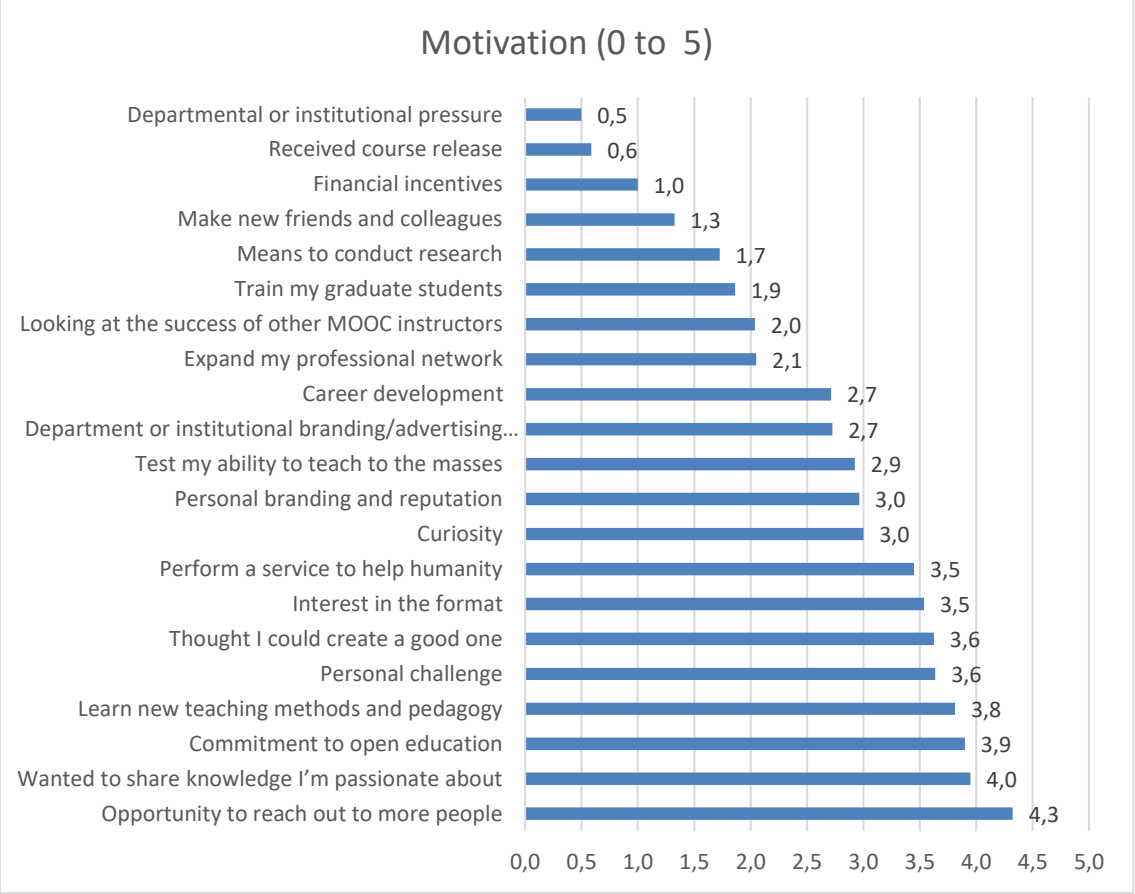
RQ 1: What motivates UPV instructors to teach MOOCs, and what support have they received from the institution?

Two questions support the answer to this research question (section a). The first one aimed to know the types of support that instructors perceive they have gotten from the university. As it is clear in Figure 4, more than half the instructors mention technical support (55% of respondents), with additional compensation and colleague support in a second tier (identified by 40% of people), and training and productivity or service recognition in a third (32.5%). Support by the administration (chosen by 15% of instructors), discretionary funding (12.5%), and course release time (selected by 11.25%) were the less mentioned types (Figure 4).



Artículo IV Figure 4: Support received by instructors

In the next question (figure 5), instructors were asked to grade different motivation factors from 0 to 5; “Opportunity to reach more people” was graded with 4.3, “Wanting to share knowledge” with 4.0, and “Commitment to open education” with 3.9. “Learning new methods and pedagogies” and “Personal challenges” also ranked high. “Personal branding and reputation” with 3.0 and “Department or institution branding” and “Career development” with 2.7 ranked in the middle of the table. Factors related to incentives as money or course release time ranked low.



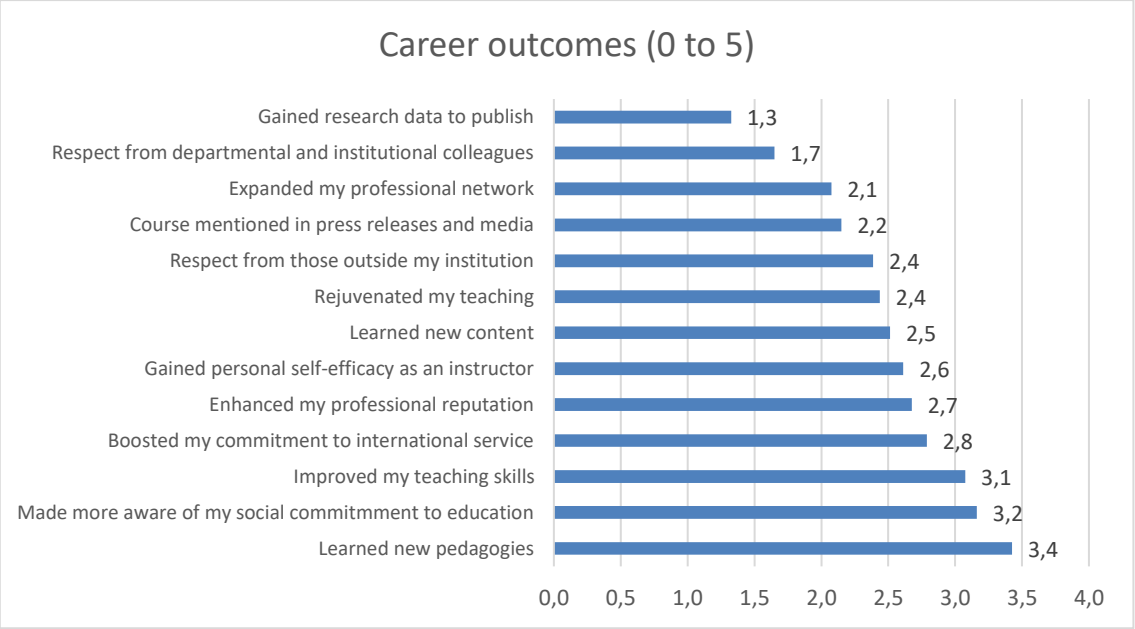
Artículo IV Figure 5: Motivational factors

RQ 2: What outcomes have instructors gotten from teaching MOOCs?

Three questions (survey section b) are aimed to answer this research question, one devoted

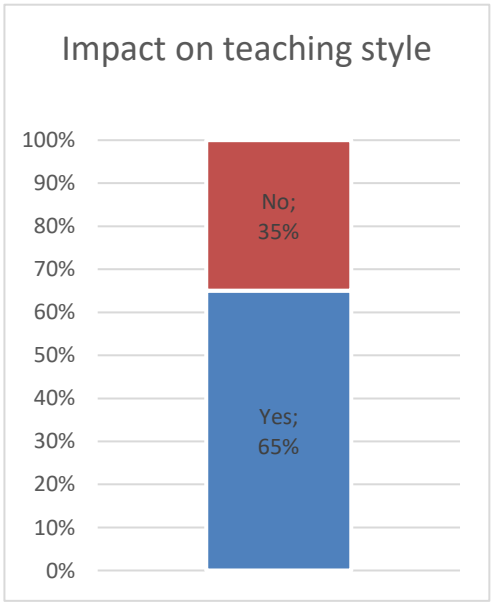
to career outcomes and the other two dedicated to asking about the impact of teaching MOOC on the instructor's teaching style.

The answers to the first question of the section (Figure 6) show that instructors consider the most important outcomes obtained to be related to learning new pedagogies (with an average of 3.4/5), increasing their social and international awareness (3.2/5), improving their teaching skills (3.1/5), boosting their commitment with the international service (2.8/5), and enhancing their reputation (2.7/5). The instructors don't seem interested in using MOOC data for research (1.3/5) or departmental/institutional respect (1.7/5).

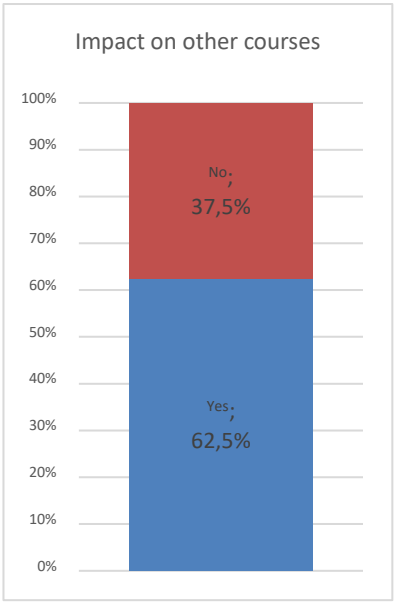


Artículo IV Figure 6: Career outcomes

Answers to the second and third questions of this section, included in figures 7 and 8, reveal that MOOCs have had an important impact on the teaching style of the instructors (65% answered yes to the question "*has MOOC teaching affected your pedagogy?*"), and 62.5% believe they have changed the way they teach other courses.



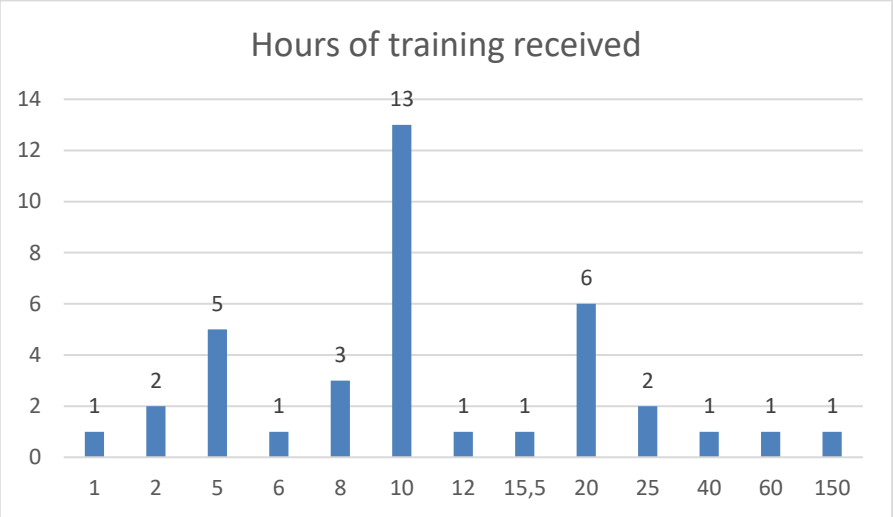
Artículo IV Figure 7: Impact on teaching style



Artículo IV Figure 8: Impact on other courses

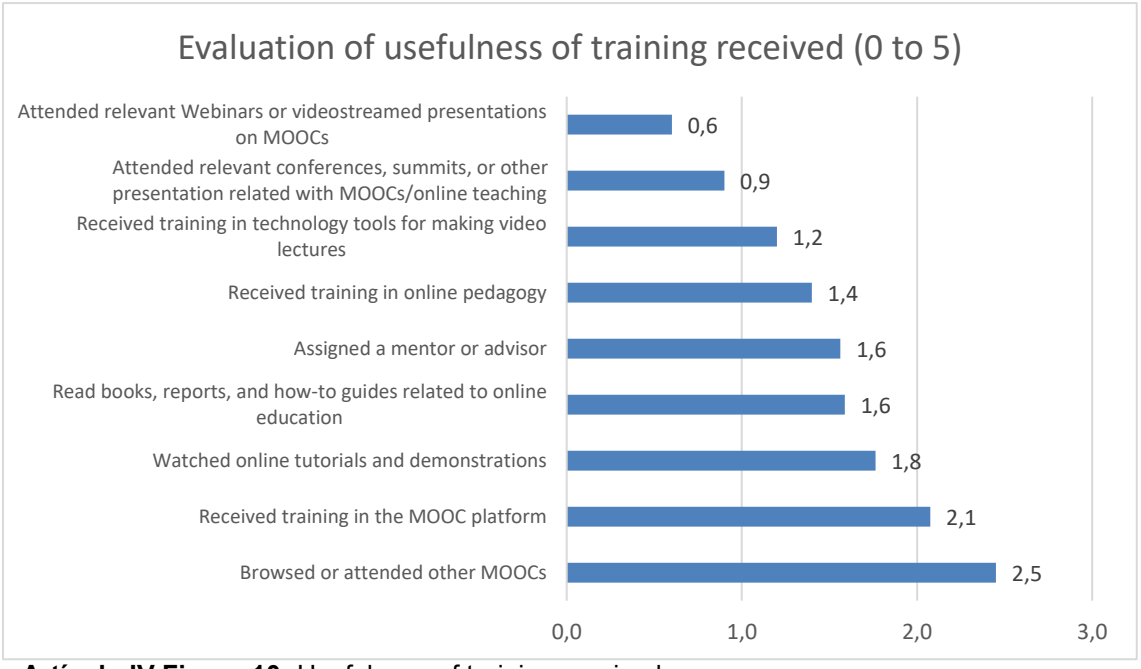
RQ3: How do MOOC instructors get their training to create and deploy MOOCs?

More than half the instructors that answered the survey (42 of 79, 53.2%) declared they had received no formal training on MOOC development. Among the other 38 instructors that participated in the survey (Figure 9), the formal training average time is 8 hours. Three instructors had received a big amount of training in the field (150, 60 and 40 hours), 13 instructors declared they had received 10 hours, 6 declared 20 hours and 5 answered 5 hours of training.



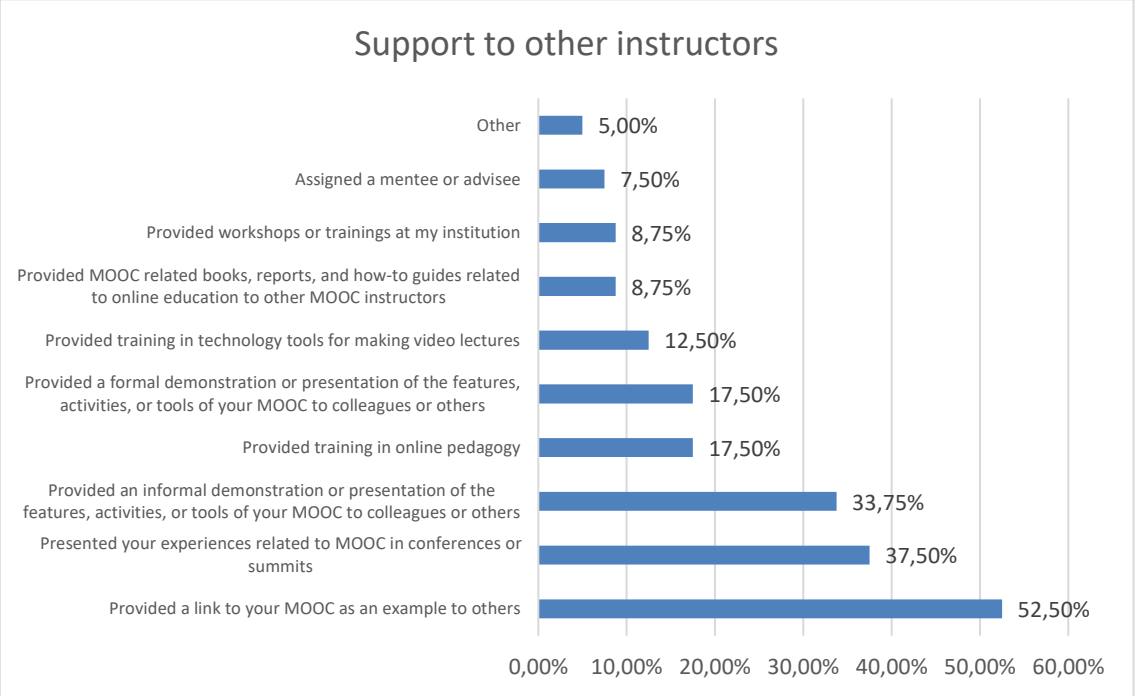
Artículo IV Figure 9: Hours of training received

As in figure 10, when instructors are asked about the usefulness of the resources they have used to learn about MOOC teaching, it is essential to remark there are no resources scored with an average higher than 2.5 (from 5 possible), and two of the resources scored beyond 2 points on average. The most valued resources are *browsing or attending other MOOCs* (that scored 2.5 on average) and *receiving training about the MOOC platform* (that scored 2.1 on average).



Artículo IV Figure 10: Usefulness of training received

According to data in figure 11, a little more than half of the MOOC instructors surveyed (52.5%) have used their MOOC as an example for other colleagues, 37.5% have presented their experiences related to MOOC in events, and 33.75% provided an informal demonstration or presentation related to their experience.



Artículo IV Figure 11: Support to other colleagues

To explore the skills that instructors considered important to improve their MOOC developing skills, the study included the open-ended question "*Which skills would you like to gain to improve your MOOC teaching?*" 34 instructors (43.03% of the entire sample) answered it. Three main themes surfaced in the coding phase: technical skills (mentioned 20 times by 25.31% of instructors), online pedagogy (mentioned 10 times in 12.65% of the answers), and presentation skills (mentioned 4 times, by 5.06% of instructors). Two answers mentioned languages capabilities, another mentioned learning about student feedback, two mentioned that they needed no extra training, two made improvement proposals to the platform, and two contained positive feedback for the MOOC team.

Delving into the technical capabilities demands, the most demanded technical skill included in the answers was the one related to generating videos (6 mentions), "*video editing in order to make them more flexible in terms of format and to integrate other types of material*" (participant 14). The second most mentioned was new technologies abilities (4 mentions), and 3D/simulation software – "*Ability to create interactive simulations, such as virtual laboratories, with significant graphic support to facilitate the acquisition of skills by students"* (participant 24)– and presentation tools (with 3 mentions each). Two answers mentioned learning more about the course statistics tool, and one mentioned learning about course development in the MOOC platform.

The training demands related to pedagogy mentioned training in MOOC learning strategies and online learning strategies (with 3 mentions each) –"…*how to reach learners online, online teaching practice*" (participant 18) , personalization of the learning experience, "*Strategies for designing pedagogically appropriate content for different learner segments"* (participant 32)–, new evaluation methods and forum dynamization (with one mention each), and the gathering of good practices (with one mention).

The four answers that mentioned presentation skills were related to improving speaking capabilities – "*diction*" (participant 20), "*the way of expressing*" (participant 31)– (3 mentions), or video presentation skills (1 mention).

RQ4 What aspects of the MOOC process do UPV instructors think can be improved and how?

46 instructors answered the open-ended question, "*What would you improve in the support offered by the university*?" 23 of the instructors answered with positive comments about the support received; 19 did not add any other suggestion –"I *can't think of anything, because it is a magnificent support*" (participant 8).

We also gathered 8 improvement suggestions from the other open-ended question in the survey (that asked about any other comment they wanted to make and was not included in the rest of the questions) and incorporated them into this question.

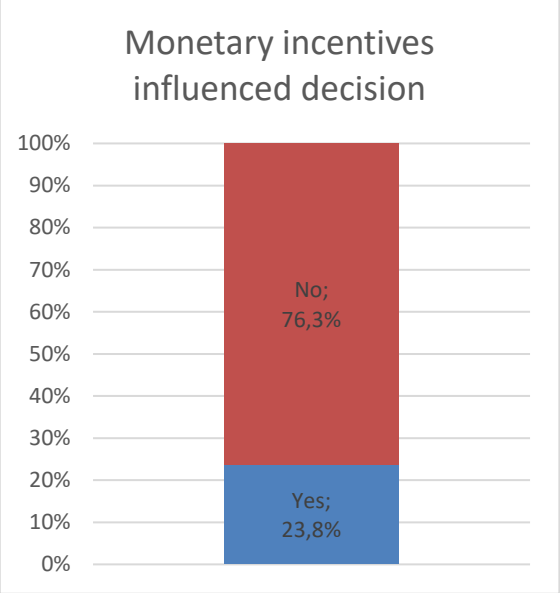
Most answers are related to the lack of formal recognition by the university of the work done, with 8 answers asking for course release time, 3 answers asking for more points for annual faculty productivity reports, and 2 answers demanding more recognition from the administration. We can see instructors think more resources should be dedicated to recognizing their dedication to MOOC preparation and running –"I *think that the UPV does not correctly value the performance of MOOCs in aspects such as IAD and POD. In the end all MOOCs are treated in a similar way, regardless of the results (enrolment, certifications, UPV image...). In my opinion, this is a mistake*" (participant 18).

Six answers ask for support in development of course materials (4 for video edition and recording, one for other video formats, one for generic support) – "*More post-recording editing to improve the final result*" (participant 18) – 5 answers ask for more resources – "*Create a stable advisory and support service*" (participant 35)– and 3 for more course promotion – "*Improve the dissemination of existing courses*" (participant 4). Two answers ask for a periodic report from the MOOC team, one asks for a more profound revision and support of senior instructor designers when starting the first MOOC, one for more training, and another for more financial support. One answer asks for a change in the mechanism of reinforcement questions and another for creating MOOC templates.

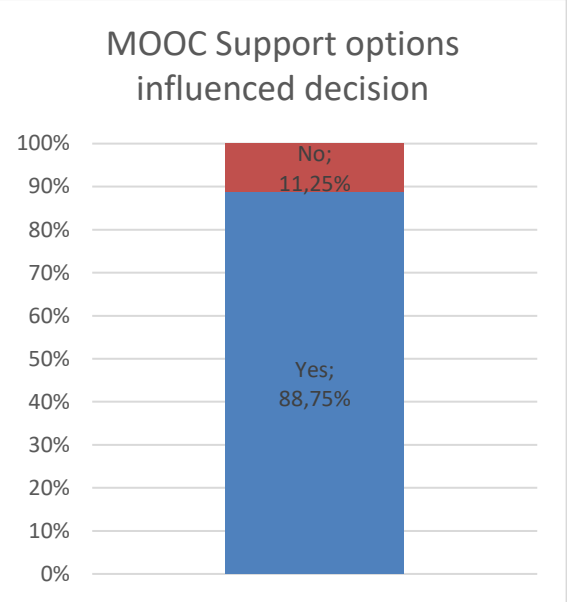
RQ5: Are instructors satisfied with their MOOC experience?

The survey contained one question that directly asked if it was worth teaching a MOOC. The answer is unanimous among instructors; all 79 instructors think it was worth having created their MOOC.

The other two questions (Figures 12 and 13) were devoted to discovering if the small monetary incentive given by the university had motivated them to make the MOOC and if the support offered by the university had helped them to decide about making the MOOC. The answers are clear, the monetary incentive did not influence the decision to make the MOOC in 76% of cases but having strong support to develop the MOOC was a very important factor to make the decision (88.75% of the sample answered yes).



Artículo IV Figure 12: Monetary incentives support



Artículo IV Figure 13: Importance of technical

26 instructors answered the open-ended question, “Any other comments you want to add”. Nine used it to ask for improvements (2 reinforcing what they answered in the former question and 8 with new demands incorporated in the previous RQ), 9 were used to make positive comments about the support provided, and 5 were used to make suggestions (about extending the use of MOOCs to all basic training and courses, linking MOOCs with continuing education, compiling success cases, giving extended support to the instructors starting their first MOOC, and incorporating YouTube formats).

In the other answers, one commented on her main motivational factor, another commented on the enlargement of his professional network as an outcome of making the MOOC, and another commented the role of MOOCs as a tool to transform teaching.

4-Discussion

This paper explores and analyses the MOOC instructor’s motivations, satisfaction, and concerns of a big MOOC initiative from a technological Higher Education Institution in Spain. It is a significant MOOC initiative with more than a hundred courses with almost 4 million enrolments that has been running since 2013, and it compares the findings with the ones made by a more global study (Young Doo et al., 2020) that reports general findings. The insights gathered will be useful for MOOC administrators and instructors, pointing to areas where improvements can be made.

This study has at least two evident limitations that have been commented along the paper. First, this research is a case study, so its conclusions can only be applied to the community of UPV MOOC instructors. Second, the survey used in this research was developed for practical purposes, so it lacks psychometric properties needed to apply certain methodologies. In addition, a more profound qualitative exploration is needed to explore other emergent possibilities, which is limited by using a questionnaire.

Focussing on the findings regarding the support received by instructors from the university, this study finds that instructors perceived that UPV had provided less technical support than the global instructors analyzed in the Young Doo et al. (2020) study reported (55% versus 63.38%) and less administrative encouragement (15% versus 55.63%). Nevertheless, they perceived to have more additional compensation (40% against 24.65%). Other compensations are similarly mentioned. The big difference is that UPV’s instructors reported

having received training twice the figure reported in the global study (26,25% versus 13.38%), a figure that is still low but significatively higher.

The conclusions in this area, reinforced by the answers to one of the open-ended questions of the survey (*What would you improve in the support offered by the university?*), are the same; more official recognition from the institutions is needed to keep most instructors motivated. They also coincide with problems reported by Zheng et al. (2016) in a similar study of MOOC instructor opinions, in which 93% of instructors mentioned lack of institutional support (resources or policy support). This is a hygiene factor as mentioned in Herzberg's 'Two-Factor Theory' (Herzberg, 2003), as official recognition of the work of MOOC instructors probably will not motivate them, yet it might encourage them to quit if not properly addressed. As seen in the question about motivation, the motivations of MOOC instructors are highly intrinsic, with reaching more people, sharing knowledge, commitment to open education, learning new pedagogies, or personal challenge as the top motivating factors. These findings are aligned with the findings of the study by Young Doo et al. (2020) that groups motivation factors in 7 categories and points the 4 categories related to intrinsic factors as the most important being the three extrinsic categories: financial incentives and course release, research purpose, and institutional goals. Zheng et al. (2016) identifies four broad types of motivations that influence instructors to teach MOOCs, listed in order of importance: global impact on students, professional growth, research opportunities, and enhanced name recognition, which is in line with the findings of this study.

These findings are optimistic, as intrinsic motivation can positively influence individuals' behaviours and attitudes toward jobs and job satisfaction (Herzberg, 2003), but institutions should not forget that instructors feel there is insufficient official recognition for the workload that a MOOC conveys, and that is a strong extrinsic factor, that, if not properly addressed, can make instructors lose their interest in MOOC (as some of the open-ended answers indicated).

Personal and institutional branding and reputation are also ranked high as motivational factors by the instructors that perceive MOOC as a good tool to showcase the quality of their work. This is also mentioned in the study by Young Doo et al. (2020).

The motivational factors are not exclusive, so institutions should deploy strategies to boost as many of them as possible, setting objectives that consider its institutional strengths and weaknesses related to MOOC.

The most important career outcomes mentioned by instructors were related to the improvement of their teaching, with the social and international commitment and professional reputation enhancement also ranking high.

The two questions about the impact of MOOC teaching in the teaching style and other courses taught by instructors remark on the use of MOOC as a tool to help instructors integrate the online paradigm in all their teaching activities.

Providing training in new technologies and pedagogies for the new online environment to their instructors is key for HE institutions to succeed in the not-so-distant future. The answers to the questions about which training instructors had received, with a little more than half of them stating they have received no formal training, are a little discouraging, considering that UPV has made a big effort to provide training opportunities to teachers (including a SPOC permanently open in the platform). One plausible explanation is that all instructors that have created MOOCs in the eight-year period from 2013 to 2021 have been surveyed, so the first instructors didn't have the training courses available when they created their MOOC. Nonetheless, these data are distant from the ones found in Young Doo et al. (2020), where fewer than 14% of the instructors declared having received formal training. This difference remarks that the training effort made by UPV has succeeded to some extent, but actions should be taken so all new instructors are trained before they start the MOOC creation process.

Teacher networks are a powerful resource, and the confirmation that half of the UPV's MOOC instructors have supported other teachers in their onboarding to MOOCs is an important indicator for institutions that should foster this type of networking by giving instructors the tools and opportunities to collaborate. This is also highlighted in Young Doo et al. (2020) findings.

When asked about which skills they would like to gain, most of the instructors mentioned technical skills in content production, online pedagogy, and presentation skills, which is in line with findings by Young Doo et al. (2020).

To the question about what can be improved and how, most instructors gave positive feedback about the support process during MOOC creation and delivery. This is probably why no instructor mentioned the problems with scaling, dealing with massive unknowns, or reputation crisis mentioned by Zheng et al. (2016).

The bigger number of demands was related to the lack of official recognition (even as the UPV gives points for annual faculty productivity reports, they are a small recognition for the effort needed), with giving course release time being the most demanded item. A second group of demands was related to having more resources to develop MOOCs, either to develop course materials, to have more support from the team, or to promote the courses. These two demands coincide with previous research regarding HE institutions' development of digital implementations (Castañeda et al., 2022).

The final questions were devoted to ask about the instructor's satisfaction with having created a MOOC, and the answer was unanimous. All instructors think the experience has been worth it. The small monetary incentive given by the university had much less influence on the decision of making a MOOC than having a strong and proactive support infrastructure to help them.

This paper has confirmed and extended the findings of the two most comprehensive studies to date about MOOC instructor motivations and concerns (Young Doo et al., 2020 and Zheng et al, 2016), but with an institutional perspective, surveying the MOOC instructors of UPV.
79 instructors answered a survey, and they all think creating the MOOC has been worth it, with having a strong and proactive support structure being one factor that influenced their decision about creating a MOOC. Their main motivators are intrinsic factors (reaching more people, sharing knowledge, commitment to open education, learning new pedagogies, or personal challenge), but instructors complain about the lack of recognition of their hard work. This can be a problem if the university doesn't increase the funding of the initiative to recognize the effort made by teachers. Taking these factors into account is key for long-term MOOC sustainability.

Many instructors created their MOOCs without formal training, which is important if the university wants to transition to online and hybrid learning. This is probably because MOOCs are a new trend, and no training materials were available initially. The university has created the training resources and encourages all new MOOC instructors to use them.

The most crucial career outcomes mentioned by instructors were related to improving their teaching, with social and international commitment and professional reputation enhancement also ranking high. MOOCs had a substantial impact on the teaching style of most MOOC instructors.

Most instructors want to improve their technical skills in content production, online pedagogy, and presentation.

All these findings remarked the importance of the strategic approach of the UPV in their MOOC initiative as a crucial factor of success, not just to increase the opportunities for expansion and international recognition, but to reinforce the positive internal perception of the

initiative and the engagement of some of the most important part the workforce implicated in it (Illanes et al. 2018, Papadimitriou, 2020; Castañeda, et al., 2022).

5-Declaration of interest

The authors declare that they have no competing interests.

6-Availability of data and materials

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy regulations.

7-Funding

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9-Appendix. Survey text

(1)¿Cuál es tu año de nacimiento? (What is your birth year?)

Selecciona de 1940 a 2000 (Select from 1940 to 2000)

(2)¿Cuál es tu género? (What is your gender?)

Hombre (Male)
Mujer (Female)

(3)¿Qué plaza ocupas en la universidad? (Which is your position in the University?)

Profesor Ayudante doctor
Profesor Colaborador
Profesor contratado doctor
Titular de Universidad (Associate professor)
Catedrático (Full professor)
Titular de Escuela Universitaria
Catedrático de Escuela Universitaria
Asociado
Profesor emérito (Emeritus professor)
PAS
Otro: (Other:)

(4)¿Cuántos cursos totalmente en línea o semipresenciales habías diseñado o impartido antes de preparar tu primer MOOC? (How many online or blended courses had you prepared before your first MOOC?)

0
1
2
3
4
5 o más

(5)¿Cuál de las siguientes compensaciones has recibido al impartir un MOOC? (Selecciona todo lo que corresponda) (Which of the following support have you received when making a MOOC -select all that apply-)

Compensación económica adicional (Additional compensation)
Apoyo o estímulo del equipo directivo de la docencia (Administrator support or encouragement)
Apoyo o estímulo de los colegas (Colleague support or encouragement)
Reducción de dedicación en el POD (Course release time)
Financiación para hacer el MOOC (Discretionary funding)
Apoyo profesional o técnico (Professional or technical support)
Reconocimiento de la docencia (Teaching or service recognition)
Formación (Training)
Puntos para los informes anuales de productividad del profesorado (Valuable item for annual faculty productivity reports)
Otro (Other)

(6) ¿Cuál es su motivación para enseñar MOOCs? (Valora de 0 a 5 cada opción donde 0 es nada y 5 es tu mayor motivación) (Which is your motivation to teach MOOC? From 0 to 5)

Desarrollar mi carrera profesional (Career development)
Compromiso con la educación abierta (Commitment to open education)
Curiosidad (Curiosity)
Conseguir marca/publicidad para el departamento o la institución (Department or institutional branding/advertising purposes)
Presión departamental o institucional (Departmental or institutional pressure)
Ampliar mi red profesional (Expand my professional network)
Incentivos económicos (Financial incentives)
Interés en el formato (Interest in the format)
Aprender nuevos métodos de enseñanza (Learn new teaching methods and pedagogy)
Observar el éxito de otros instructores de MOOCs (Looking at the success of other MOOC instructors)
Hacer nuevos amigos y colegas (Make new friends and colleagues)
Realizar investigaciones docentes (Means to conduct research)
Oportunidad de llegar a más personas (Opportunity to reach out to more people)
Realizar un servicio social de ayuda (Perform a service to help humanity)
Desafío personal (Personal challenge)
Marca personal y reputación personal (Personal branding and reputation)
Reducción de dedicación POD (Received course release)
Probar mi capacidad de enseñar de forma masiva (Test my ability to teach to the masses)
Pensar que puedo crear un buen curso con formato MOOC (Thought I could create a good one)
Capacitar a mis estudiantes de posgrado (Train my graduate students)
Compartir conocimientos que me apasionan (Wanted to share knowledge I'm passionate about)

(7) ¿De qué manera la enseñanza del MOOC ha mejorado tu carrera? Valora de 0 a 5 donde 0 es nada y 5 es de forma muy significativa (How has MOOC teaching improved your career?? (from 0 to 5)

Me ha ayudado a entender el compromiso internacional de mi institución (Boosted my commitment to international service)
Me ha hecho más consciente del compromiso social de la Educación Superior fuera de la universidad (Made more aware of my social commitmment to education)
Mejoró mi reputación profesional (Enhanced my professional reputation)
Amplié mi red de contactos profesionales (Expanded my professional network)
Gané autoeficacia personal como instructor (Gained personal self-efficacy as an instructor)
He obtenido datos de investigación para publicar (Gained research data to publish)
He mejorado mis habilidades de enseñanza (Improved my teaching skills)
He aprendido nuevos contenidos (Learned new content)
He aprendido nuevas estrategias didácticas (Learned new pedagogies)
Mi enseñanza ha rejuvenecido (Rejuvenated my teaching)
He ganado respeto de los colegas del departamento y de la institución (Respect from departmental and institutional colleagues)
He ganado respeto por parte de quienes no pertenecen a mi institución (Respect from those outside my institution)
La publicidad del curso en los medios de comunicación ha incrementado mi reputación pública (Course mentioned in press releases and media)

(8) ¿La enseñanza de un MOOC ha tenido un impacto significativo en tu manera de enseñar? (Has teaching a MOOC affected your way of teaching?)

Sí (Yes)
No (No)

(9) ¿La enseñanza de un MOOC ha cambiado tu forma de enseñar otros tipos de cursos? (Has teaching a MOOC changed your way of teaching other courses?)

Sí (Yes)
No (No)

(10) ¿Has apoyado, formado o proporcionado sugerencias a otros instructores de MOOC en lo que respecta al diseño o el seguimiento de los MOOCs? (Have you supported or made suggestions to other MOOC instructors regarding the design or tutoring of a MOOC?)

Sí (Yes)
No (No)

(11) ¿Qué tipo de apoyo proporcionó has proporcionado a otros instructores de MOOC? (marca todo lo que corresponda) (Which support have you provided to other MOOC instructors?)

He sido asignado como mentor o asesor (Assigned a mentee or advisee)
He presentado mis experiencias relacionadas con los MOOC en conferencias o congresos (Presented your experiences related to MOOC in conferences or summits)
He proporcionado libros relacionados con los MOOC, informes y guías prácticas relacionadas con la educación en línea a otros instructores de MOOC (Provided MOOC related books, reports, and how-to guides related to online education to other MOOC instructors)
He proporcionado formación sobre práctica docente en línea (Provided training in online pedagogy)
He proporcionado capacitación en herramientas tecnológicas para hacer conferencias en video (Provided training in technology tools for making video lectures)
He impartido talleres o capacitaciones en mi institución (Provided workshops or trainings at my institution)
He proporcionado un enlace a mi MOOC como ejemplo para otros (Provided a link to your MOOC as an example to others)
He proporcionado una demostración o presentación formal de las características, actividades o herramientas de mi MOOC a colegas u otras personas (Provided a formal demonstration or presentation of the features, activities, or tools of your MOOC to colleagues or others)
He proporcionado una demostración o presentación informal de las características, actividades o herramientas de mi MOOC a colegas u otras personas (Provided an informal demonstration or presentation of the features, activities, or tools of your MOOC to colleagues or others)
Otro (Other)

(12) ¿Has recibido alguna formación o taller relacionado con los MOOC o la enseñanza con tecnología antes o durante el diseño de tu MOOC? (introduce el número de horas aproximadas que has recibido de formación, si no has recibido introduce 0) (Have you received any training or workshop related to MOOC or online teaching before or while designing your MOOC? Introduce the number of training hours, or 0 if not received any))

Por favor, escriba su respuesta aquí: (Please write here your answer)

(13) Valora de 0 a 5 la utilidad del tipo de desarrollo profesional que recibiste antes de diseñar o impartir tu curso MOOC (seleccionando 0 si no recibiste ese tipo de formación) (Rate from 0 to 5 the usefulness of the training you received before creating your MOOC (select 0 if you did not receive that type of training)

Me asignaron un mentor o asesor (Assigned a mentor or advisor)
Asistí a conferencias relevantes, congresos u otras presentaciones relacionadas con los MOOCs o la enseñanza en línea (Attended relevant conferences, summits, or other presentation related with MOOCs/online teaching)
Asistí a webinars relevantes o presentaciones transmitidas en video sobre MOOCs (Attended relevant Webinars or videostreamed presentations on MOOCs)
Consulté o realicé otros MOOCs (Browsed or attended other MOOCs)
He leído libros, informes y guías prácticas relacionadas con la enseñanza en línea (Read books, reports, and how-to guides related to online education)
Recibí formación sobre práctica docente en línea (Received training in online pedagogy)
Recibí formación sobre la plataforma MOOC (Received training about the MOOC platform)
Recibí formación en herramientas tecnológicas para hacer videoconferencias (Received training in technology tools for making video lectures)
Vi tutoriales y demostraciones en línea (Watched online tutorials and demonstrations)

(14) ¿Qué tipo de habilidades y conocimientos te gustaría adquirir para mejorar tu enseñanza de los MOOCs? (What skills and knowledge would you like to gain to improve your MOOC teaching?)

Por favor, escriba su respuesta aquí: (Please write your answer here)

(15) ¿Crees que te merece la pena haber creado el MOOC o MOOCs? (Do you think that creating one or several MOOC has been worth it?)

Sí (Yes)
No (No)

(16) ¿Los incentivos proporcionados por la iniciativa Docencia en Red de la UPV te han ayudado a decidirte a crear el MOOC? (Have the monetary incentives provided by the Docencia en Red initiative helped your decision to make a MOOC?)

Sí (Yes)
No (No)

(17) ¿El soporte proporcionado por la iniciativa MOOC de la UPV te ha ayudado a decidirte a crear el MOOC? (Has the support provided by the MOOC initiative helped your decision to make a MOOC?)

Sí (Yes)
No (No)

(18) ¿Qué mejorarías en el soporte proporcionado por la iniciativa MOOC de la UPV? (What would you improve in the support provided by UPV's MOOC initiative?)

Por favor, escriba su respuesta aquí: (Please write your answer here)

(19) Dejamos esta última pregunta de texto libre por si quieres comentar algo que no haya tenido cabida en las otras preguntas. (This is an open-ended question if you want to comment on anything that has not been included in former questions.)

Por favor, escriba su respuesta aquí: (Please write your answer here)

4.2. RESULTADOS DEL USO DE LOS MOOC POR LOS ESTUDIANTES

En el periodo en el que se estaba confeccionando esta tesis se produjo el confinamiento forzoso debido a la pandemia de COVID-19, lo que forzó a adaptar muchos procesos educativos para que fueran realizados en línea para lo que la UPV aprovechó su experiencia en el campo MOOC y su disponibilidad de cursos. En esta tesis hemos incluido dos artículos que estudian como la UPV utilizo los MOOC de edX (incluidos los suyos) para cubrir las prácticas en empresa que tuvieron que dejar de hacerse y cómo ofreció a su comunidad universitaria todos los MOOC que edX puso a su disposición para que sus miembros tuvieran un recurso formativo de calidad para utilizar mientras estuvieron confinados.

En ambos artículos se estudian las características de los estudiantes, los cursos que han hecho y se les pregunta por su opinión sobre la iniciativa y los cursos, con lo que dan respuesta al tercer objetivo de la tesis, siendo complementados por un estudio sobre los datos generales de los alumnos que todavía está en revisión y que se aporta más adelante.

El tercer objetivo de la tesis es:

3. Estudio del proceso desde el punto de vista de los estudiantes:
    - 3.1. Describir las características del estudiantado que ha participado en la iniciativa y el uso que han hecho de los MOOC
    - 3.2. Conocer la opinión de los alumnos sobre la iniciativa y los cursos
    - 3.3. Indagar si, tras conocer la iniciativa, están dispuestos a hacer más MOOC en el futuro y a pagar por sus certificados
    - 3.4. Analizar e identificar los focos de mejora identificados por los estudiantes

ARTÍCULO II: "What Does the Data Say about Effective University Online Internships? The Universitat Politecnica de Valencia Experience Using MOOC during COVID-19 Lockdown"

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Article

What Does the Data Say about Effective University Online Internships? The Universitat Politècnica de València Experience Using MOOC during COVID-19 Lockdown

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Abstract: Universitat Politècnica de València's students can take in-company internships during their bachelor's degrees, and, with the COVID-19 lockdown, 224 students had their internships cancelled. EdX launched a free certificate initiative for its partners, and UPV gave the possibility of using MOOCs to cover for the credit needed to graduate. We have tried to answer the question, "Is it possible to use MOOCs to replace an in-company internship in an emergency?" using Learning Analytics; 179 students chose this possibility. More than 90% of the students got their academic credit, and their satisfaction with the initiative was 4.6/5. They scored MOOCs' quality with 4/5 and the contribution of MOOCs to their careers with 3.6/5; 95% will take a MOOC, and 69.3% think it is worth paying for the certificate. The answers to the question evaluating if MOOCs had given them the same knowledge as a company internship are positive but much less conclusive, with an average of 2.87/5. We conclude that MOOCs achieved the pursued goal during the emergency. With more time for planning and extra resources for remote support, they can be a good solution in environments where online is the only choice, and they can even be used as a tool to reinforce some of the knowledge needed to be successful in a traditional internship.

Keywords: MOOC; lockdown; COVID-19; company internship; replacement

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1. Introduction

In 2020, countries started enforcing massive lockdowns to stop the spreading of the COVID-19 pandemic. Most of these confinements included school and university closures [1] that created many academic problems for students and teachers to follow and complete their educational programs. MOOCs (Massive Open Online Courses) were used as an option to address the need for quality online material for higher education institutions [2,3].

This paper shows the experience of Universitat Politècnica de València (UPV) using MOOCs to cover students' academic internships during COVID-19 in the context of the RAP (Remote Access Program), a program of free MOOC certificates offered by edX during the first lockdown.

This paper aims to study an emergency case in which face-to-face education was not an option and an online education option had to be adopted, to see if some findings can be applied to other situations in which learning online is the only possibility. It also tries to see if the knowledge acquired with MOOCs can be helpful in any way for traditional internships.

The paper proposes two research questions:

Research Question 1: Can MOOCs cover the knowledge acquired in a company internship in a forced online environment, like the one found in a strict lockdown?

Research Question 2: Were the students satisfied with the outcomes of the solution provided by UPV?

It is critical to review MOOC history and their peculiarities to understand how UPV arrived at this solution.

Using MOOCs in higher education started almost at the beginning of the movement, growing slowly but accelerating in 2018, a year which saw a significant increment in the number of MOOC-based degrees offered [4]. Many things have happened since 2008 when David Cormier and Bryan Alexander first mentioned the term MOOC to refer to the course created by Stephen Downes and George Siemens, 'Connectivism and Connective Knowledge/2008' (CCK8), in which 2,200 students learned actively among peers [5].

The term MOOC was definitively popularized at the end of 2011 to refer to courses launched by Stanford University that had over 100 thousand enrolments each [6], in a format more similar to the traditional Higher Education model that was later called x-MOOC, to differentiate these courses from the original MOOC format called c-MOOC [7]. The big numbers created a media hype about a new educational revolution, so big that 2012 was called by some media "the year of the MOOC" [8], and some articles proclaimed that MOOCs were the most important educational technology in 200 years [9].

This made many Higher Educational Institutions (HEIs) worldwide experiment with these courses [10]. At the end of 2020, there were over 16,300 courses from 950 universities worldwide with over 180 million enrolments [4], with thousands of platforms offering MOOCs [11], ranging from country platforms to small niche ones [12].

In 2021, MOOCs are used in one of the most successful online graduate degree programs in the United States of America (USA), the Online Master of Science in Computer Science (OMSCS) from the Georgia Institute of Technology, with over 5,000 students graduated since it started in 2013 [13]. At first, very few masters of this type were created. Still, in 2018, there was an acceleration in the number of programs developed, and now over 70 MOOC-based online graduate programs have been created by 27 universities [14].

Soon after the media explosion of attention regarding MOOCs, critics pointed that the dominant x-MOOC model introduced no pedagogical innovation at all [15]. Four barriers to their widespread adoption were detected: there was a need to develop revenue models that made the concept self-sustaining, MOOCs should deliver valuable signifiers of completion such as credentials, badges, or acceptance into accredited programs, course completion was very low, and, finally, it is challenging to authenticate students, so it satisfies accrediting institutions or hiring companies [16].

MOOC dropout rates and low completion figures are a significant concern that has been extensively addressed in the literature [17][18][19][20][21]. But there is no consensus that these figures are really a sign of failure [22], and some authors state that learners' intent should be taken into account when defining the success of MOOCs [23]. In fact, the completion rates of students pursuing a certificate (as is the case of this study) are much higher [24].

Despite these problems, in 2016 edX platform started offering Micromasters that gave access to academic credit in HEIs, and Coursera followed in 2018 with Mastertracks [25]. These two initiatives opened the possibility to use MOOCs to expand the internal HE academic offer and integrate other external offers into the own HEIs' one. In 2021, all major platforms will offer these academic credit-bearing micro-credentials [26]. Consequently, there is an increasing number of experiences of universities granting academic credit for external MOOCs, either integrating them in blended courses ([27];[28]), accepting micromaster credentials as part of one of their masters ([29];[30]), using them in interuniversity networks as the virtual exchange program [31] or letting the students create a module of their bachelor studies using MOOCs [32].

Big MOOC platforms, like edX, Coursera, and so on, generate large amounts of data, which not only offer users enormous possibilities of interoperability and access but also allow educational institutions the possibility of making a certain level of monitoring compatible with the certification needs [33].

Therefore, MOOCs are also being used in several initiatives to include migrants and refugees in Europe [34]. Some, as Kiron NGOs, use them to create study tracks that give them access to higher education through partnerships with German universities but are finding low completion rates, probably due to a combination of several factors: recognition issues (as the procedures of recognition of certificates are complex and unclear), different expectations of students (that have very different

backgrounds and situations), the problematic conditions of refugees, a low threshold approach (as the offer is open to any refugee with interest in Higher Education) and the preference for the 'warm support' that blended learning offers [35].

The 2020 COVID-19 lockdowns were an unexpected but global litmus test for online learning around the world. They revealed strengths and weaknesses of long-standing initiatives, offering an extraordinary opportunity to test MOOCs possibilities that were hitherto unthinkable but that became the only option under the circumstances. During these confinements, one of the biggest problems for covering the academic offer of universities was related to the covering of students' academic internships in external institutions. Some HEIs used MOOCs to cover them, from different approaches and with various results [36].

Learning Analytics, defined as "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs" [37],[38], could help us evaluate the effectiveness of those adaptations beyond students' satisfaction or their perceived quality [39].

The key value of this experience lies in its double vision. On the one hand, it is about validating the possibility of offering an online alternative for university students to carry out internships -based on the use of online resources external to the university- when face to face is not an alternative. On the other hand, it offers the possibility of evaluating the efficiency of this alternative using the Learning Analytics provided by the system to complement the participants' vision in the activity.

2. Materials and Methods

This paper is structured as a case study. It is a research approach to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context [40] that helps the institution to answer the research questions.

2.1. Case study Context

Universitat Politècnica de València (UPV) is a middle-sized public university from Spain that in 2020 offered 46 bachelor's degrees from 13 schools in which 20,200 students were enrolled [41]. In most of these degrees, the students can do an internship in a company as part of their studies during a variable amount of time that usually can be as long as a third of one of the four years of the degree.

In March 2020, the students of the last course that had chosen the internship option were already taking their internship or would start it when a massive lockdown started to be enforced in Spain to contain the spread of the COVID-19 pandemic. No one could go out of their homes, a situation that lasted until June 2020, so most were cancelled, all but the few that could be continued working from home).

Most of these students needed to complete the academic credits assigned to their internships to get their degrees on time. It was uncertain for how long we would be confined, and they couldn't wait until they could retake their internships, so the University had to look for a solution for them.

As soon as 11 March 2020, edX, the global MOOC platform, mobilized to help its university partners support their students during lockdowns and maintain continuity in their activities and created a RAP initiative (Remote Access Program) [42]. The initiative saw the creation of an edX partner community group, where members could access the courses and programs of any other member at no cost. This collaborative effort allowed universities to offer their communities over 800 courses, with immediate access to online learning opportunities in a broad array of subject areas. In a few days, over 60 edX partners from all over the world joined the program to deliver blended and independent learning opportunities for students - as well as professional development for faculty and staff - through 30 June 2020 [43], and UPV was one of them, offering all its MOOCs to be included in the initiative. The initiative worked distributing promotional codes to the different institutions that waived the certificate fees for the included courses.

The internships department of UPV saw that this initiative was a good opportunity to give the students an option to cover the remaining credits of their internships and created a protocol to do so.

Each bachelor's and master's degree from the University has an academic governing commission called ERT, so these commissions were instructed to select a list of courses from the initiative related to their degree that covered the competencies to be developed in the internships. Then students had to prepare a plan selecting courses from this list to cover for their remaining credits and present it to their tutors in the internship and the member of the ERT in charge of internships who had to approve it.

Once the courses were finished, the student had to present a finishing report and the certificates of the courses to the same two faculty, that had to validate it and send a report to the internships department.

2.2. Materials and data instruments

The main sources of information have been the Learning Analytics provided by the MOOC platform and the academic system.

In addition, and as a complement, the institution has sent a satisfaction survey to people who had used MOOCs to cover their internship.

In the anonymous survey, the information gathered was: demographic information (age, gender, residence place, job status and level of studies), information about the initiative (level of satisfaction from 0 to 5, number of codes requested, number of codes used, number of certificates obtained), information about the motivations to participate (reasons to participate), previous knowledge about MOOCs, future use of MOOCs (intention to take MOOCs in the future, willingness to pay for MOOC certificates, reasons to pay for MOOC certificates), information about every MOOC taken (institution, name of MOOC, quality of the from 0 to 5, contribution to the professional career from 0 to 5, finalization of the MOOC), an open field for comments and a specific question asking if MOOCs had given them the knowledge they would have acquired from the internship from 0 to 5.

The structure and content of the survey were validated using a content and face validation [44] process that guarantees the appropriateness and relevance of the items as they appear to the persons answering the survey [45].

2.3. Data Analysis

For the study, a table from UPV's internship department database has been used. All data from the applications of the students that were doing an internship (or going to star one when the lockdown was enforced) and wanted to change the remaining academic credits of their internships were recorded. In the table obtained from the internship database, each record has several fields of which the most important ones are: the school, the name and surname of the student, the gender of the student, the state of the evaluation (finished or not), the number of academic credits to be covered and an unstructured text field that describes the educational project proposed by the student and what they finally did in the end.

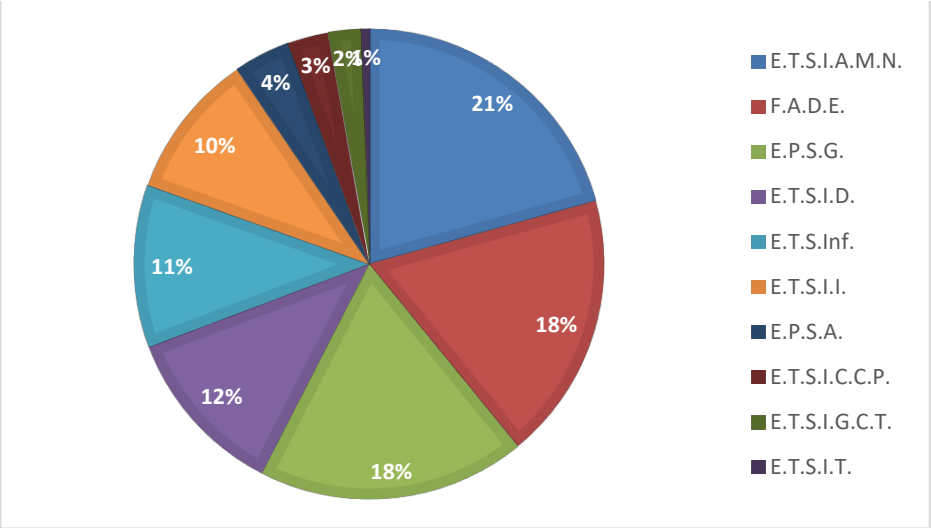
The unstructured text field was processed to extract the different MOOCs used by students to a different table, with one record per MOOC.

For analysing survey data, averages and standard deviation of every quantitative answer have been obtained. Considering the sample is a convenience sample (only those that participated answered the survey), statistical inference values (as p-values or size effect) have been avoided due to the "inference becomes tricky or outright impossible" [46].

2.4. Participants

Of the 3,500 students in the course 2020-2021 that were in the last year of their bachelor studies, 227 needed a solution to cover the credits of the internship they had scheduled. Of these 227, 179 students (78.9%) chose to make a learning plan using MOOCs to cover the academic credits not completed. These students are considered the population of our study.

The students came from 10 of the 13 university schools with the distribution that can be seen in figure 1(the names of the schools are listed in table 1).



Artículo II Figure 1. Distribution of participants by school

Artículo II Table 1. Universitat Politècnica de València Schools

ETSIAM	Agronomical engineering school
FADE	Business management school
EPSG	Gandía city polytechnical school
ETSID	Design engineering school
ETSInf	Computer Science school
ETSII	Industrial engineering school
EPSA	Alcoi city polytechnical school
ETSICCP	Civil engineering school
ETSIGCT	Geodesical engineering school
ETSIT	Telecommunication engineering school

There were 109 (60.9%) male and 70 (39.1%) female students in the group, which is similar to the distribution of gender at UPV (38.5% female) and the students' gender distribution of the technical universities from the region [47].

The satisfaction survey about the initiative was sent to every person who participated in the RAP initiative from the UPV community. We received 1,515 answers, of which 101 were from students who had used MOOCs to cover their internship, 56.7% of the 179 participants in the internship project.

As it has been stated, this paper analyses the student's records in the internships department, the platform databases and the student's answers to the survey to look for an answer to the research questions, as they can shed light about using MOOCs to obtain the knowledge in an activity that requires in-person attendance, as a company internship, where there is a forced online environment.

3. Results

Reviewing the data from the internship department and the platform databases of the 179 students that chose the MOOC option:

- 162 (90.5%) have a "passing" grade in the status field of the database
- 17 (9.5%) have a note that says that their internships were cancelled

Those data means that, for 90.5% of people that participated in the project, the academic commissions of the different schools considered that MOOCs gave students enough knowledge to cover the objectives of the internships and officially validate them.

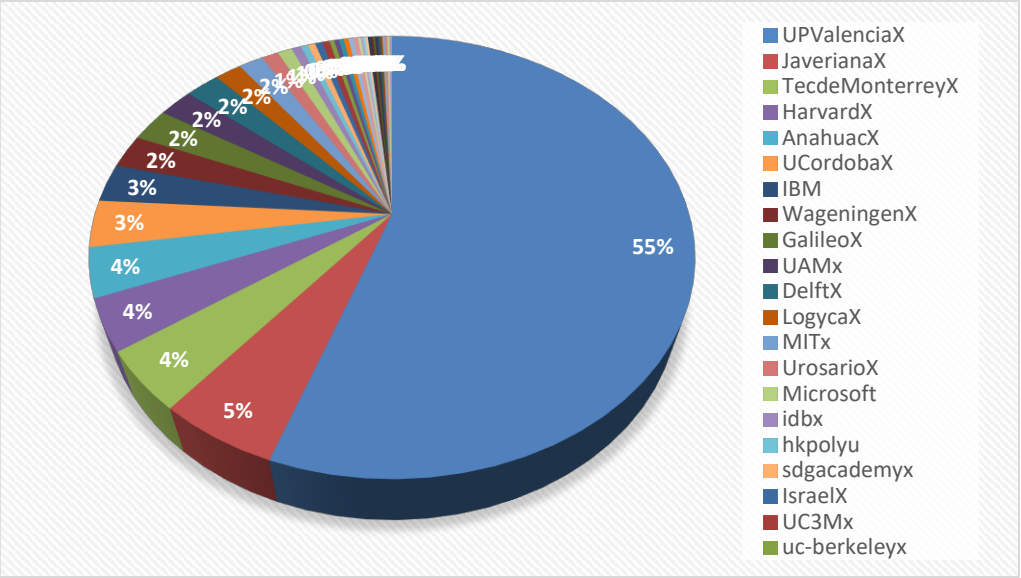
The students chose 636 MOOCs from 193 MOOCs offered by 40 institutions, with an average of 3.55 per student.

With the courses, students covered 1594 credits (ECTS, European Credit Transfer and Accumulation System), 1569.5 curricular credits (needed to get their degree) and 24.5 extracurricular credits (that enrich the student record but are not counted for the total credits the student needs to get the degree). In total, only 8 students took MOOCs to get non-curricular credits (5 mixed with curricular credits and 3 only for non-curricular credits). The maximum credits students covered with these MOOCs were 18, and the mode was 6 curricular ECTS per student, as seen in table 2.

Artículo II Table 2. ECTS. Distribution for curricular and non-curricular credits.

	Curricular ECTS	Non-curricular ECTS	Total, ECTS
Max	18	5,5	18
Mode	6	0	6
Average	8.57	0.19	8.76

518 (81.4%) of the courses chosen by students were in Spanish and 118 (18.6%) in English. As shown in Figure 2, most (55.5%) are from the own institution.



Artículo II Figure 2. Percentage of courses per institution.

Regarding what courses students preferred, data show that 26 courses concentrate more than half the enrolments. 10 of them (those included in Table 3) reunite more than a third of enrollments. The most popular courses are focused on practical skills and tools very in demand in the business world, with the ones devoted to Excel as the most popular (first, second and fourth position). One course that explains Sustainable Development Goals (ODS in Spanish), another about project management, and a couple about leadership are also high on the list.

Artículo II Table 3. Number of enrolments per course in the 10 most popular courses

Course	Number of enrolments
Excel: gestión de datos (Excel: Data management)	43
Excel: fundamentos y herramientas (Excel: Fundamentals)	32
ODS en la Agenda 2030 de las Naciones Unidas: Retos de los Objetivos de Desarrollo Sostenible (SDG in UN 2030 Agenda: Challenges for SDGs)	28
Excel avanzado: importación y análisis de datos (Advanced Excel)	23
Introducción a la gestión de proyectos (Intro to Project management)	22

Gestión participativa: motivación y liderazgo organizacional (High involvement work practices: motivation and organizational leadership)	18
Liderazgo para mandos intermedios (Leadership for middle managers)	16
Diseña presentaciones eficaces con Powerpoint (Powerpoint Presentations)	14
Finanzas personales (Personal finance)	13
Buscar en internet (Search Internet)	12

The students using MOOCs for the internship were tagged before sending the general survey about the initiative so that a specific question could be added. 101 (56.7%) students of the 179 who used MOOCs to cover their internship answered the survey.

The average satisfaction with the initiative of these 101 students is 4.57/5 with an sd (standard deviation) of 0.93, slightly smaller than the general satisfaction 4.7/5 (sd 0.7) calculated with the answers of the total 1,515 members of the UPV community that answered this question.

They score the quality of the MOOCs they have taken with 4/5 with sd 1.3 (slightly smaller than the one obtained from all 1,515 answers with 4.1/5 and sd 1.04). Their score of how much the MOOCs they have taken can contribute to their professional career is 3.7/5 with sd 1.39 (a figure slightly higher than the one obtained from all answers (3.6/5 with sd 1.26).

The 162 students with a "passing grade" got 574 MOOC certificates, with an average of 3.54 certificates per student.

Of the 101 students who answered the survey, 96 (95%) responded that they would enroll in other MOOCs to acquire new knowledge, and 70 (69.3%) considered that it is worth paying for the certificates.

But how did these courses cover their expectations to fulfill their academic internships in this emergency? To the question "rate from 0 to 5 if MOOCs have given you the knowledge that you would have obtained from a company internship, where 0 is "I haven't acquired any knowledge related with the internship" and 5 is "MOOCs have given me the same knowledge" the results, 2.87/5 with sd of 1.7, are still positive but much less conclusive, as 40 of the 62 students that answered to the question gave a rating of 3 or more, as seen in Table 4.

Artículo II Table 4. Number of students per score points in the question related to the internship

Score	Number of students
0	9
1	7
2	6
3	13
4	15
5	12

Looking at the data from the 16 students that answered 0 or 1 to this question, their satisfaction with the initiative is 4.3/5 (sd 0.92), they score the quality of the MOOCs they have taken with 3.67/5 (sd 1.48), and they score that the MOOCs they have taken can contribute to their professional career with 3.3/5 (sd 1.48), figures 10% lower than the averages for all survey responders, but still positive.

Analysing the 21 comments that the students using MOOCs to cover for the internship left in the open response field, we see that 16 are positive, 2 neutral and 3 negative.

In the positive comments, the students were very happy and grateful for the experience and the opportunity, stressing the importance of continuous training, especially in times of confinement:

"Excellent initiative; I have nothing more to add. I only offer my thanks for having participated in this great learning process." Comment N. 6.

"Above all, the Excel courses have been very useful for me, as I'm studying 4th year of Telecommunications and they haven't taught us anything about Excel. And I think it is very important and necessary to know how to use it when working in a company. It could be improved by adding more content. Since the possibilities offered by the programme are very broad, and in 3 courses you can't cover them all." Comment N.2.

"I consider it extremely opportune to continue with the release of codes that encourage the continuous training of students, preparing us better and complementing our classroom knowledge.". Comment N. 20

In the case of neutral comments, they remarked on the positive character of the initiative, but with some suggestions for future editions:
"The courses, in general, are good; what I regret is not having had enough time to do them and having to do the courses "in a hurry" to be able to homologate them to my internship". Comment N. 9

Negative comments are very negative, pointing out that they think that MOOCs are not a good alternative for the internships:
"I don't think that the edX courses validate an internship in a company. I know it was only because of the extraordinary situation due to COVID, but it doesn't even compare" Comment N. 12
"It is one of the worst solutions I have seen to solve the problem I had when I didn't do an internship. I couldn't do an internship and I was left without that professional experience that is required of every student coming out of engineering." Comment N. 19

Seven comments asked for the continuation of the free certificate initiative.

4. Conclusions and Discussion

The closure of our educational institutions –and companies– during the COVID19 confinements confronted us with unprecedented situations that forced governments to take emergency measures for the universities' academic activity to continue and avoid further damage to the careers of our students.

The results explored in this work answer positively to the first research question: 90.4% of students using MOOCs to substitute the internships have a "passing" grade in the status field of their internship in the academic database of the University. Hence, the academic commissions of the different schools considered that MOOCs gave students enough knowledge to cover the objectives of the internships.

The average satisfaction with the initiative of students using MOOCs for internships that answered the survey is 4.57/5, and they scored the quality of the MOOCs they took with 4/5. These figures are similar to the 4.7/5 average course rating reported by Coursera in the 2021 Coursera Impact report [49].

Students' score of how much the MOOCs they have taken can contribute to their professional career is 3.7/5. 95% answered that they would enroll in other MOOCs to acquire new knowledge, and 69.3% considered it worth paying for the certificates.

All of the above indicates that the answer to the second research question is yes, students were quite happy with the initiative and the quality of the courses they took and that they think that MOOCs are a very good tool for learning

Knowing that the academic commissions of the different schools considered that the knowledge acquired was enough and that the students are happy with the initiative and the quality of the courses, there is only one more thing to look at to answer the first research question and see if MOOCs can cover for the knowledge acquired in a company internship in a forced online environment, the answers to the question of the survey specifically devoted to this subject. Most students (64.5%) think they have obtained knowledge similar to the one they got with the internship. Still, the agreement about this statement is much lower, as 14.5% think that MOOCs haven't given them at all the knowledge they would have acquired in an internship, and 11.3% believe they have got only a small part of the knowledge. If we look at the negative comments of the open response field, 3 students are furious at substituting the internship with MOOCs. However, there are 16 positive comments and 2 neutral ones from students using MOOCs for their internship, so the comments are mostly positive, and the answer to the first research question is also yes.

The results are similar to those observed in an experience in India [36], where 75.5% of students were satisfied with the contents and delivery of MOOCs to substitute their internship, and 91.8% answered that they would continue to enhance their knowledge and skills through MOOCs. In this experience, the perception of students about if MOOCs gave them equivalent learning to the internship is much higher (95.5%).

Looking at the courses chosen to cover for the internship, having over 800 courses to choose from, offered by some of the most prestigious universities in the world, students chose courses in their

language from their university and focused on practical skills and tools very in demand in the business world.

We have used Learning Analytics to answer the research questions, and we can conclude that, given the passing grades granted by the academic commissions and the opinions of the students about the initiative, the courses and the coverage of the knowledge they expected to get from the internships, MOOCs have been a good tool to provide an important part of the knowledge by company internships. Students are very happy with the initiative of providing them free certificates for the MOOCs. They think that the quality of the MOOCs they have used is very good and that they will be useful to improve their professional careers.

Most think MOOCs have given them an equivalent to the knowledge they would have acquired with a company internship, but there is room for improvement. The initiative was an emergency solution that had to be deployed on the fly with no planning or extra support. The student proposed the MOOC itineraries they wanted to follow, and the schools' academic boards approved them.

With a little more time and resources, the MOOCs to be taken by each student could have been chosen with the school support, some extra projects could have been assigned to each student with remote support from a pool of teachers, and remote teams could have been organized to give them the possibility to work their teamwork competence. This is in line with the findings of [36] that indicate that positive social influence and better facilitating conditions improve perceived ease of use and perceived usefulness leading to better user satisfaction in a similar experience of using MOOCs to cover for internships during the lockdown.

In addition, we have confirmed in this experience that the Learning Analytics usually accessible in the xMOOC classic model –that is the one generalized in the most popular platforms–, do not give participants and institutions much information about what is happening inside the courses and do not enrich the almost entirely "black box" perspective of courses. The ambition of enriching the type of LA collected by platforms and managing those data by participants would be interesting to enhance these initiatives in the future [25].

In conclusion, this case study shows that, when a remote environment is compulsory and face-to-face is not an option, MOOCs can be a good tool to provide an important share of the knowledge that a student can get in a company internship. Looking at the answers of the discontent students, we think that, in an "out-of-emergency" context, careful planning and the addition of some extra activities and resources to support students remotely could make them an excellent tool to gain some of the skills developed in this type of internships.

Looking at the valuation that students gave to the quality and the usefulness of the MOOCs they took, and the answers to the question about it they had obtained a knowledge similar to the one they got with the internship, we think that MOOCs can also be used to reinforce traditional internships, introducing itineraries of previous mandatory courses on basic skills (Excel, teamwork, leadership, project management, Python programming, etc.) adapted to the specific internship the student is going to take.

The conclusions obtained are based on the grades granted by the academic commissions and the opinion of the students about the knowledge they were going to obtain with the internships. One limitation of the study is that these are indirect means of checking that the knowledge acquired in a company internship has been obtained. Another limitation is that students had no prior experience of what knowledge they were going to get with the internships, only expectations about it, so their evaluation is based on these expectations.

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ARTÍCULO III: "MOOCs as a massive learning resource for a Higher Education Community. The Universitat Politècnica de València experience using the EdX Remote Access Program."

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MOOCs as a massive learning resource for a Higher Education Community. The Universitat Politècnica de València experience using the EdX remote access program

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Abstract
During the 2020 COVID-19 lockdown, edX launched an initiative, called the Remote Access Program, to give access to free certificates for its Massive Open Online Courses (MOOCs) to the communities of its partners. This paper describes the experience of a Higher Education (HE) institution in Europe par- ticipating in this initiative as a strategic action to spread MOOCs, not just as a resource to open the university educational offer but also to improve the pro- fessional development possibilities of its community. This case study explores general data about the participation of over 7,700 people (23,4% of the Uni- versitat Politècnica de Valencia's community) in these courses and data from participants (1,515) about their initiative perceptions. The data obtained evalu- ates how a university community integrates MOOCs into their day-to-day life under certain conditions and their perception of the quality and usefulness of the courses. Data shows most of the community did not have experience or knowledge about MOOCs (73%), they used it (they obtained 5,202 certificates, a 33% completion rate), they value the course quality (4.1/5) and are happy with the initiative (4.7/5), and they think MOOCs will be useful for their career (3.67/5) and will take more MOOCs in the future (98%, with 71% think- ing it is worth paying for the certificate). These results remark the importance of thinking about MOOCs in HE Institutions not just as a punctual resource but as a strategic investment affecting the university teaching offer, the profes- sional development of its community, and their social compromise.

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1. Introduction

MOOC, the acronym for Massive Open Online Courses, coined in 2008 by David Cormier and Bryan Alexander to refer to the course created by Stephen Downes and George Siemens, 'Connectivism and Connective Knowledge/2008' (CCK8), in which 2,200 students worked and learned actively (Siemens, 2012), was popularised in late 2011 when Stanford university launched courses with over 100 thousand enrolments each (Rodriguez, 2012), in a format later called x-MOOC (Lugton, 2012).

This considerable success brought media attention to MOOCs and was amplified so that 2012 was called by some media the year of the MOOC (Pappano, 2012). Even articles said MOOCs were the most important educational technology in 200 years (Regalado, 2012). Many universities around the world started experimenting with MOOC courses (Shah, 2013).

But soon, critics commented that MOOCs were nothing more than an incremental evolution of the educational technologies already available and that the dominant x-MOOC model introduced no pedagogical innovation, even stating that the first MOOC was created in 1922 with the open courses at the University of New York broadcasted using a radio station (Bartolomé, 2013). Some even considered that MOOCs were near the peak of inflated expectations of the Gartner Cycle (Schmidt, 2012).

Some articles pointed to the four barriers MOOC had to overcome: developing revenue models to make the concept self-sustaining, delivering valuable signifiers of completion such as credentials, badges or acceptance into accredited programs; increasing course completions and creating ways to authenticate students, so it satisfies accrediting institutions or hiring companies (Hill, 2012).

Ten years after the first x-MOOCs were launched, many questions remain to be solved (Margaryan, Bianco & Littlejohn 2015; Rolfe, 2015; Toven-Lindsey, Rhoads, & Lozano 2015, among others). Some related to more critical visions on the interpretation of the role of MOOC in the Higher Education (HE) portrait (Bulfin, Pangrazio & Selwyn, 2014) and some related to the pedagogical implications of those "massive" teaching models (Bartolomé-Pina & Steffens, 2015).

Probably, some of the most critical challenges are achieving self-sustainability, finding sources of revenue and ways to keep costs low (Conole, 2014; Shah, 2016; Schuwer et al., 2015). During these years, the prominent MOOC platforms have been drifting from the "open" model, putting part of its content after a paywall (first the certificates, later the graded assignments) (Shah, 2017). The MOOC model in the big platforms is drifting towards the well-established business model of online postgraduate and continuing education while keeping the problems that were already detected in the early years: low completion rates and with most of its learners being already educated individuals from the most affluent countries of the world (Reich & Ruipérez-Valiente, 2019).

But even as the original problems have not been solved, and MOOCs are still struggling with sustainability and low completion rates, the MOOC movement has continued its almost exponential expansion and, at the end of 2020, there were over 16,300 courses from 950 universities worldwide with over 180 million enrolments (Shah, 2020), with thousands of platforms offering MOOCs (OpenedX, 2018), ranging from country platform to small niche ones (OpenedX, 2021), and the term MOOC has been the objective of the study of an impressively high number of literature reviews ranging from 2013 (e.g., Liyanagunawardena, Adams & Williams, 2013), until more recent times (e.g., Babori, 2020).

Using MOOCs in HE started soon and followed a slow but steady path that accelerated in 2018. In 2016 edX started offering Micromasters, micro-credentials that give access to academic credit, and Coursera followed in 2018 with Master tracks (McIntyre, 2018). All major platforms offer these academic credit-bearing micro-credentials (Pickard L., Shah D. & De Simone J.J, 2018). But one of the big questions that surround the universities' commitment to

developing MOOCs, is to what extent this course - their creation and use - can contribute to developing the aims of HE (Papadimitriou, 2020) and not only to its Uberification (Adell, Castañeda & Esteve-Mon, 2018).

Before the CoVid-19 pandemic unleashed in 2021, there were some experiences of universities granting academic credit for MOOCs from other universities, either integrating them in blended courses (Khan, 2019), accepting micro master credentials as part of one of their masters (edX, 2021; MIT, 2021), using them in interuniversity networks as the virtual exchange program (Delft University, 2021) or letting the students create a module of their bachelor studies using MOOCs (NUS, 2021).

So, when COVID-19 disease hit the world at the beginning of 2020, and many countries enforced massive lockdowns to stop the spreading of the disease, most including school and university closures (Hale et al., 2021), MOOCs were an excellent option to address the need of quality online material for HE institutions (Ponce Ceballos & Ruelas Mexía 2021; Duan 2021). MOOCs were even used to train teachers for the sudden transition to online learning (Mays et al. 2021; Boltz et al. 2021), or even to train the sanitary personnel about the COVID-19 disease (Seale et al. 2021; Quijano-Escate et al. 2020; Utunen et al. 2020). The pandemic became a litmus test for the MOOCs and their potentials, not just as free resources for complementing formal education, but as strategical learning resources for professional development inside and outside our institutions worldwide. But how does it was?

This paper describes the experience of Universitat Politècnica de València (UPV) using the Remote Access Program Initiative (RAP) from edX to spread the use of MOOCs as an alternative training possibility during CoVid-19 lockdowns in 2020 among its community members. The data obtained evaluate how a university community integrates MOOC on their day-to-day life under the conditions of the Covid-19 lockdown, their participation, their perception about quality and usefulness of the courses; some findings on this case have exciting implications for educators and policymakers about how to integrate and use MOOCs as alternative learning resources.

2. Case Study Context: The UPV and the edX Remote Access Programme

UPV is a mid-sized public university that has committed over the last decade to use MOOC as one of its strategic levers to digital transformation, not only as digital resources to complement its educational offer but also as part of its social engagement (Despujol, Castañeda & Turro, 2018). UPV joined the edX–one of the leading MOOC worldwide platforms with over 160 partners, 3000 courses and 35 million users– at the end of 2014, and now, this institution is the leader of its Spanish speaking offer, with over 100 courses and 3.5 million enrolments at the moment of writing this paper.

In March 2020, when massive lockdowns started to be enforced worldwide to contain the spread of the COVID-19 pandemic, edX created a partner community where members could access the courses and programs of any other member at no cost. This initiative was called the “Remote Access Program” (RAP) (Randall, 2020a).

In a few days, over 60 edX partners from all over the world joined RAP (Randall, 2020b). The UPV joined the programme understanding it as an opportunity to help other edX partners communities with the UPV generated MOOCs and an excellent opportunity to offer external high-quality educational content to the UPV local community.

All RAP participating members could ask edX for an unlimited number of codes during the initiative –through June 30 of 2020–as edX sent more codes when the institutions asked for them. The free access was achieved using promotional codes that edX sent in CSV format text files to each customer institution by mail. These codes had to be distributed to the users of the customer institution. They could be redeemed when purchasing the certificates of the courses included in each initiative to get it for free.

UPV distributed 24,613 codes to 7,712 of its students, faculty and workers, so around 23.4% of its 33,042 community members (UPV had 29,009 students, 2,579 faculty and 1,454 staff (UPV, 2021)) asked for at least one code.

3. Study

This study explores an innovative experience of using MOOCs as the primary learning resources (RAP) for a whole university community in the context of a HE Institution (UPV) during the CoVid-19 crisis lockdowns. The study's primary goal is to evaluate the experience and its potential consequences on the use of MOOCs in HE in a massive way.

For doing it, this study formulates the following research questions:

- RQ 1: Who participated in the experience?
- RQ2: What kind of courses do participants choose and from what institutions?
- RQ3: Does the experience increase the knowledge about the potential of MOOCs among the university community?
- RQ4: Is the use of MOOCs in a massive open way a satisfactory experience for participants?
- RQ5: Under what conditions would participants use MOOCs and certifications in the future?

The exploration has been structured as a case study, as it is a research approach to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context (Crowe et al., 2011). This study case is considered evaluative but with a descriptive approach (Cohen et al., 2018).

Consequently, this study includes the narrative from the team who developed the institutional implementation of the experience –this info has been included in the previous section of "study context"– and uses three data sources, a survey to obtain a detailed description of participants perceptions about their experience, the database of code requests, with the emails of the users, and the summary of learning analytics of the initiative, provided by edX, to get the total number of codes redeemed and the total number of certificates obtained.

The survey included the collection of:

- Demographic information (age, gender, residence place, current job status and level of studies)
- Information about the initiative
    - satisfaction level, WITH A SCALE from 0 to 5 where 0 is the minimum
    - number of requested codes
    - number of used codes
    - number of obtained certificates
- Information about the motivations to participate
- About MOOCs
    - Previous knowledge about MOOC
    - Intention to take MOOC in the future
    - Reasons to choose a MOOC
    - Willingness to pay for MOOC certificates
    - Reasons to pay for MOOC certificates
- Some information about each one of the MOOCs taken (institution, name of MOOC, quality of the from 0 to 5, contribution to the professional career from 0 to 5, finalisation of the MOOC)

The structure and content of the survey were validated using a content and face validation (Holden, 2010) process that guarantee the appropriateness and relevance of the items as they appear to the persons answering the survey (Connell et al., 2018).

1,515 people from the 7,712 who asked for at least a code answered the survey (19.4%). The survey was sent at the end of September 2020, almost three months after the RAP initiative ended. Even if it is not a randomised sample, the percentage of the population included and the range of ages and profiles included (data will be shown in the results part) makes them incredibly valuable for understanding the experience (Hibberts et al., 2012).

The data provided by edX shows that 15,744 of the codes provided to UPV were redeemed and that 5,202 certificates from different institutions were obtained (a 33% completion rate). It also shows that around 27% of UPV codes were used to get certificates for UPV courses.

Quantitative information has been analysed, calculating the averages and standard deviation of every answer for all the answers. It has been studied differentiating university students and workers (including part-time students, alumni and university staff). In the analysis, statistical inference values (as p-values or size effect) have been avoided, considering the sample is not a random sample, so the "inference becomes tricky or outright impossible" (Hirschauer, Grüner, Mußhoff, Becker & Jantsch, 2021: 1), and researchers preferred to maintain the importance of the size of the sample, rather than artificially randomise it.

Regarding comments on the survey, they have been analysed under a content technique, classifying them as positive, neutral or negative.

3. Results

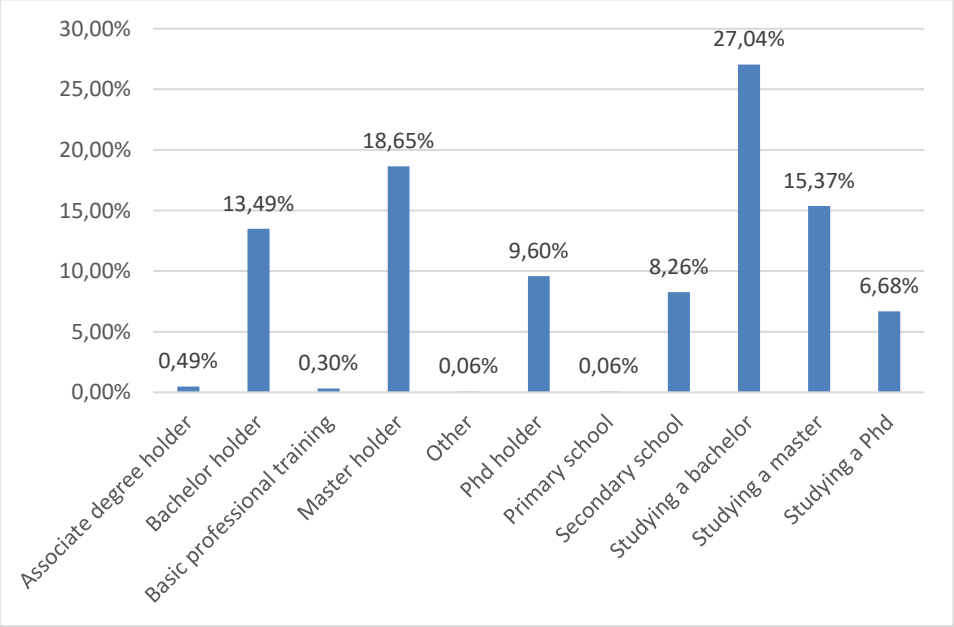
In this section, data and results are shown. Data have been organised using the Research Questions order.

3.3. RQ 1: Who participated in the experience?

There were two main collectives involved in the initiative, University students and employees. But, even the initiative was communicated only to the active members of the community, any email account from the upv.es domain was able to ask for codes of the initiative; therefore, former students, members of the alumni association –with an email from the alumni.upv.es domain–, could also participate. So, according to the email domain that requested codes, participation in the initiative among the community members groups was 77.4% students, 18.4% employees, and 4.2% alumni.

Regarding data collected with the survey, 60% of the responders were male and 40% female and that the average age was 29.4 years, with a peak in 22 years and another smaller and flatter peak in 50 years.

Concerning the maximum level of education achieved by the respondents to the survey, we find two big groups, the ones that in the moment of the initiative were studying a bachelor, a master or a PhD (48.19%) and the ones that already had it (41.5%). Moreover, as is shown in figure 1, some people with primary or secondary education (10.31%), as their maximum level of education, also participated in the initiative:

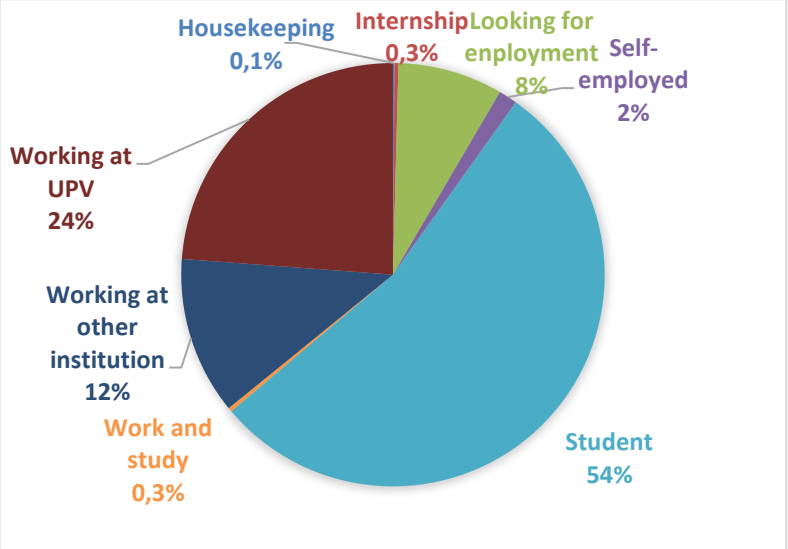


Artículo III Figure 1. *Level of education achieved.*

Concerning the employment status of participants, the answers in the survey show that 54.3% of participants define themselves as students or interns, 24% as working at UPV, 12.1% as working for other institutions, 8.45% as looking for a job, 1.6% as self-employed, 0.25% as working and studying and 0.07% as housekeeping as seen in figure 2.

Considering the anonymity of the survey –we don't have access to the email respondents–, the analysis of those answers regarding employment status using the level of education answers can give a more global perspective about the profile of respondents. Therefore, since 22.2% of respondents have answered they are working for other institutions, looking for a job, self-employed and/or housekeeping, using data from the level of education we see some studying a bachelor, a master or a PhD, what identifies them as students that are working and studying part-time, and the rest are alumni. Therefore, considering the other answers regarding the employee status, 7.2% of this 22.3% can be considered students and 14.2% alumni. 61.75% of the responders were students (54.3+7.2+0.25), 24% UPV employees and 14.2% alumni.

The answers from these groups will be included in the same group as the working for UPV group when looking for differences between working people and students' responses, given their working experience.



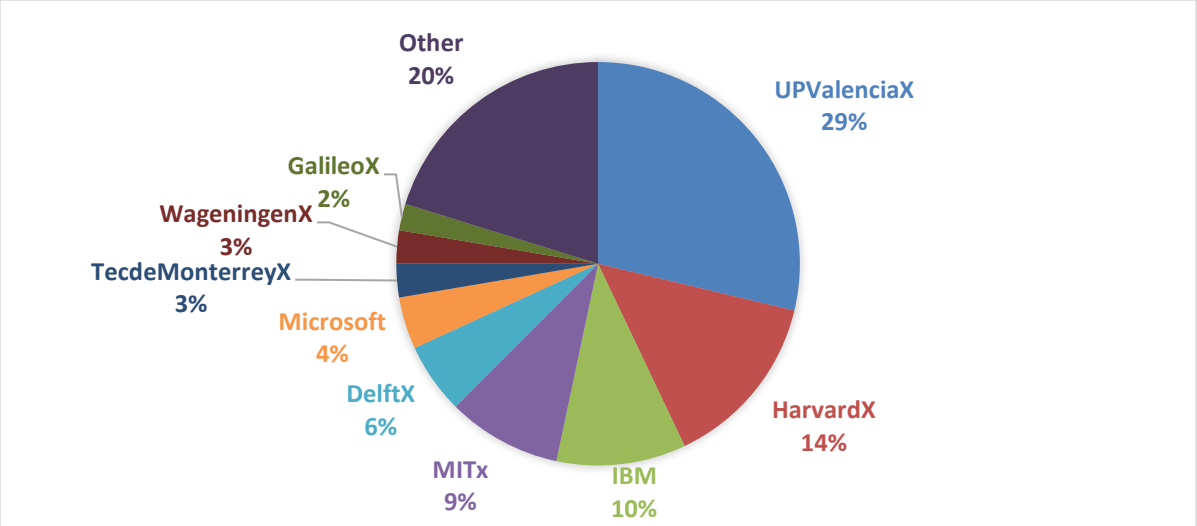
Artículo III Figure 2. *Employment status.*

Most users (87.4%) resided in Comunitat Valenciana (the Spanish region where UPV is located), up to 95.2% including other regions of Spain, and the rest in different countries of Latin America and Europe (Ecuador 1%, Colombia 0.65%, México 0.42%, Germany 0.42%, Denmark 0.3%, UK 0.24%, Perú 0.24% or France 0.18%, for example).

3.4. RQ2: What kind of courses do participants choose and from what institutions?

The answers of the survey include 3,237 ratings of 690 courses from 67 edX member institutions.

The data provided by edX indicates that 27% of the codes granted to UPV were used to get certificates from UPV courses. In light of the survey data in figure 3, the figure is very similar, 28.7%.



Artículo III Figure 3. Percentage of courses per institution.

As presented in table 1, the most popular courses reported by users in the survey focus primarily on Excel, Python and R, applied to data analysis.

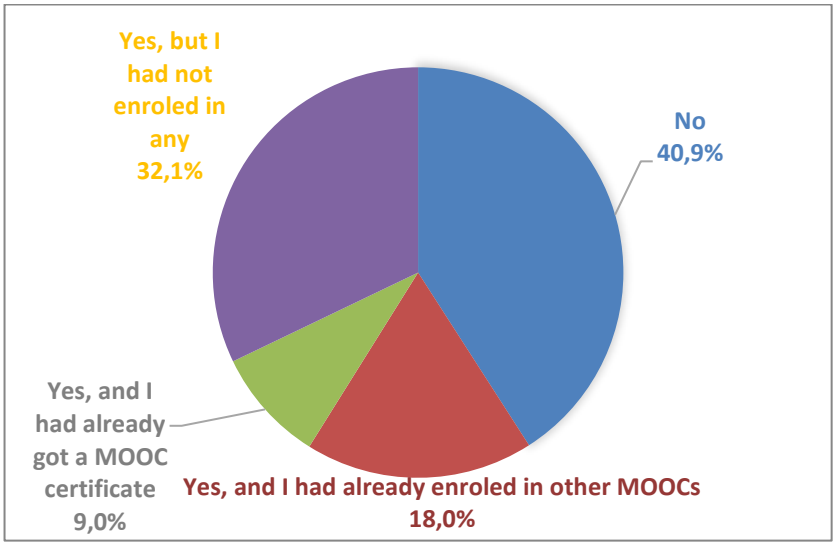
Artículo III Table 1. Number of enrolments per course in the 20 most popular courses

Course	Number of enrolments
Excel: gestión de datos (Excel: Data management)	115
Excel avanzado: importación y análisis de datos (Advanced Excel)	83
Excel: Fundamentos y herramientas (Excel: Fundamentals and tools)	71
Analysing Data with Python	52
Python: aprender a programar (Python: learn how to code)	43
Introducción al Office 365 (Intro to Office 365)	40
Statistics and R	39
Analysing and Visualising Data with Excel	39
Data Science: R Basics	38
Introducción a la inversión bursátil (Intro to stock invesment)	37
Python Basics for Data Science	37
CS50's Introduction to Artificial Intelligence with Python	36
A Hands-on Introduction to Engineering Simulations	33
CS50's Introduction to Computer Science	33
Machine Learning with Python: A Practical Introduction	32
Introducción a la gestión de proyectos (Intro to project management)	31

Introduction to Data Analysis using Excel	30
Using Python for Research	27
Visualising Data with Python	27
Android: Introducción a la Programación (Android: Intro to coding)	27

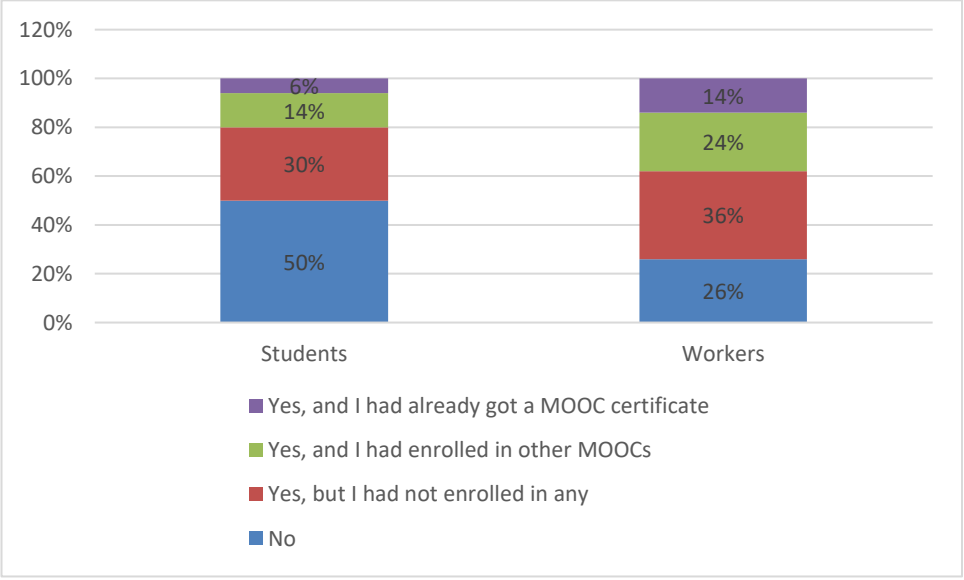
3.5. RQ3: Does the experience increase the knowledge about the potential of MOOCs among the university community?

Regarding the survey answers, almost 41% of the respondents knew nothing about MOOCs before they participated in the initiative, and 32% knew about them but hadn't taken any, for a total, 73% of the users, as is evident in figure 4.



Artículo III Figure 4. Previous Knowledge about MOOC.

Differentiating students and workers data, as shown in figure 5, 49.7% of students didn't know about MOOCs before they participated in the initiative, and 30.2% knew about them but had not enrolled in any (a total of 79.9%). With workers, 26% didn't know about MOOCs in advance, and 35.4% knew about them but had not enrolled in one (a total of 51.4%).



Artículo III Figure 5. Previous Knowledge about MOOC by group.

3.6. RQ4: Is the use of MOOCs in a massive open way a satisfactory experience for participants?

For understanding the participants' level of satisfaction with the experience, the study explores not only how many used their codes but how many obtained the final certification. Additionally, at the survey, participants were asked about their level of satisfaction and how useful they perceive the courses they have developed for their careers.

As the data in table 2 remark, the average number of codes requested by a user was 3.84 with a standard deviation (sd) of 2.3 (there was a considerable dispersion, with users requesting from 1 code to 25 codes), most users (38%) asked for five codes, but there were 76 users (4.4%) that asked for more than five. The average number of codes used was 3.2 (sd 2.19). The average number of certificates achieved by a user was 1.8 (sd 1.91), but the courses could be finished several months after the initiative was closed, so the users were still taking courses when the survey was sent. The average number of certificates still in process per user was 1 (sd 1.40).

Artículo III Table 2. Used codes and certificates obtained per number of demanded codes

Demanded codes	% of users	Used codes on avg.	Certificates obtained avg.	Certificates in process avg.
1	16.87%	0.91	0.35	0.22
2	12.76%	1.60	0.75	0.34
3	13.03%	2.41	1.31	0.74
4	8.86%	3.28	1.75	1.05
5	43.45%	4.30	2.34	1.32
6	1.06%	4.94	3.69	1.31
7	0.53%	6.25	2.75	3.50
8	0.40%	6.17	4.33	3.00
9	0.07%	9.00	4.00	5.00
10	2.18%	8.03	4.76	3.00
13	0.07%	13.00	13.00	-
15	0.26%	12.75	4.75	7.00
20	0.33%	16.80	14.20	2.00
22	0.07%	2.00	2.00	-
25	0.07%	22.00	16.00	-
Total	100.00%	3.24	1.76	0.99

Looking at the total data provided by edX it can be seen that 15,744 of the codes provided to UPV were redeemed and that 5,202 certificates from different institutions were obtained (a

33% completion rate).

In the survey, users affirmed to have obtained an average of 1.8 certificates (sd 1.91), and 84% got at least one certificate (71%) or was in the process to obtain one or more certificates (13%). Around a third of respondents (446 participants, 29%) declared they had finished no MOOC, and more than a half of which (242 participants, 16% of the total respondents) said that they were not in progress of getting one (the other 204 reported that they were still in the process of getting one or more certificates).

1,515 participants answered the survey question about rating their satisfaction with the initiative from cero to five, and average satisfaction is 4.7/5 with a small dispersion (sd of 0.7). Satisfaction among students was 4.73/5 (sd 0.67) and among workers 4.64/5 (sd 0.73).

Asked the participants to score the quality of each of the MOOCs they had taken, the average score among respondents is 4.1/5 (sd 1.04). The average given by students is 4.09/5 (sd 1.05), and the average from workers' answers is 4.14/5 (sd 1.01).

The survey had an open response field for comments, and 296 participants (15.99% of respondents) left their comments. Tagging the answers as positive, negative or neutral in a qualitative coding process, 220 (74.3%) were positive –most thanking for the initiative and asking for its continuation–, 40 (13.5%) neutral –asking for more time, more codes or making comments about diverse aspects– and 36 (12.1%) negative–some complaining about the deadlines of the courses, others about the quality of a specific course and some about the use of MOOCs to cover for internships-.

The survey also asked users to rate from 0 to 5 how useful they thought that each of the MOOCs they had taken could be for their professional career. The average rating is 3.67/5 with a sd of 1.26. The rating given by students is 3.71/5 (sd 1.24) and by workers 3.59/5 (sd 1.3).

RQ5: Under what conditions participants would use MOOCs and certifications in the future?

To explore the possibility that participants will use MOOCs in the future for their professional development and under what conditions they should do it, the study asked them why they joined the initiative if they will use MOOCs in the future, as well as if they think that it is worth paying for MOOC certificates, and which are the reasons that would make them willing to pay for the certificates.

Regarding the reason to join the initiative, participants were asked to score from 0 to 5 some options with the results shown in table 3.

Artículo III Table 3. Reasons to join the initiative.

Reason to join the initiative	average	Students	workers
Improve my resume	3.97	4.04	3.86
Gain new professional skills	4.49	4.49	4.47
Take a course from a prestigious institution	3.26	3.32	3.16
Take advantage of my free time	2.65	2.66	2.65
Learn new things	4.31	4.28	4.35
Curiosity about MOOCs	2.72	2.70	2.74

Differences between students and workers are negligible, with “gaining new professional skills” as the main interest and “learning new things” as the second. The workers are more interested in learning new things and the students in improving their resumes).

98% of all respondents say they will take a MOOC in the future. For the students, the figure is 98.2%, and for the workers, 97.5%

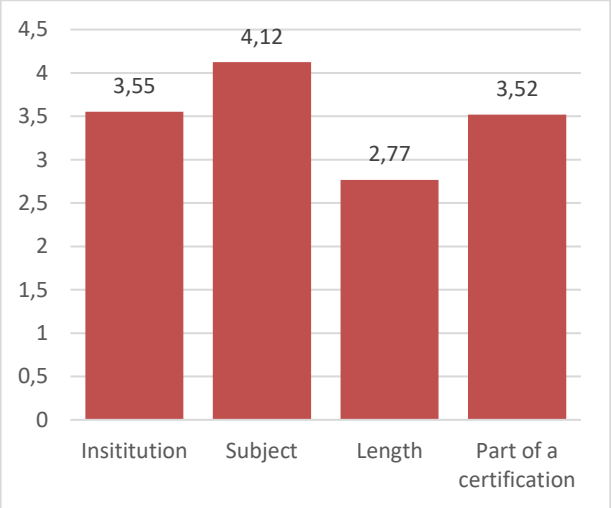
71% of all respondents say they think it is worth paying for the verified certificate of a MOOC. For the students, the figure is 71.4%, and for the workers, 70.7%.

Moreover, participants were asked to score from 0 to 5 these options as the reason to make a MOOC, and the results can be seen in table 4:

Artículo III Table 4: Reasons to make a MOOC

Reason to make a MOOC	average	Students	workers
The institution that created the course	3.55	3.54	3.57
The Subject	4.12	4.14	4.10
Course Length	2.77	2.78	2.75
Course being part of a professional certificate	3.52	3.55	3.48

Differences between students and workers are negligible, with “Subject” as the main reason to pay for a course and the institution that created the MOOC as the second, as seen in figure 6.



Artículo III Figure 6. Reasons to pay for a MOOC.

4. Discussion and Conclusion

This paper presents an analysis of the UPV community experience using the RAP edX initiative during the 2020 lockdown. The experience (free access certificates for most MOOCs edX catalogue) and the 7,712 participants, around 23.4% of the total university community, make this study case a good example for technological HE in the western world.

The analysis leads to the conclusions presented and discussed below using the RQs order:

RQ 1: Who participated in the experience?

Distribution of the different groups in the emails of the code requesters and the answers to the survey reflects that the employee participation was higher than its quota in the university (they

accounted for 18.4% of the requests when they represented around 11.5%, following the current university composition).

But considering the demographic data gathered in the survey, the initiative was participated by a population that reflects the composition of the UPV university community, at least in terms of gender and age. The distribution of gender of the respondents (60% male and 40% female) corresponds almost perfectly with the 38,5% of female students in UPV (Generalitat Valenciana, 2021) and the 40% of women in the UPV workforce (UPV 2021). Distribution of age is also coherent with the three populations (students, employees and alumni) of the universities from the region (Generalitat Valenciana, 2021). Employees and alumni answered more to the survey than students in percentage (14.2% of respondents were alumni when they represented 4.2% of the code requests, and 24% of respondents were employees when they are 18.4% of the code requesters). In addition, the data of level of education achieved show a 41% of degree holders, which is coherent with the 38.2% of answers from employees and alumni.

The significant conclusion around this RQ is that participation in this local initiative, with these particular pandemic conditions, has reflected very well the age distribution of universities but has been more frequent among people educated (University staff and alumni), which is similar to participation in MOOCs in other general initiatives. For instance, in the first four years of MOOCs at Harvard and MIT (2012 to 2016), the median age was 29 years, and the percentage of bachelor's degree holders was 73% (Chuang I. & Ho A., 2016). By its part, in the Macro MOOC learning analytics of global and regional providers (Ruipérez-Valiente et al., 2020), the most common age range across MOOC platforms is 25-35 years, and the percentage of men and people with a bachelor or higher degree of education are even higher than the ones we find for most of the MOOC platforms. Finally, in the Guo & Reinecke (2014) study –4 edX MOOCs with 140,546 students– and found that the mean age was 28, the most common highest educational level for students was a bachelor's degree (38%).

Therefore, even if this is a local initiative focussed on a particular population, the MOOCs revalidate its character of resource for educated people.

It is interesting as well to remark that data from the UPV experience regarding gender reflect very well the composition of its local community; nevertheless, the gender differences are very similar to most general MOOCs experiences, as the one reflected by Chuang & Ho (2016), where the percentage of female was 33% or the one of Guo & Reinecke (2014), where most students were men (between 86% and 56% for all four courses). So, the gender gaps vastly studied for technical degrees all over the world (and reflected in the composition by gender of the UPV community) are very similar to the gender gaps access to MOOCs, at has been stated (Jiang, Schenke, Eccles, Xu, & Warschauer, 2018).

RQ2: What kind of courses do participants choose and from what institutions?

The UPV community chose mainly courses from its university (28%) and some of the most prestigious institutions in the world (Harvard, MIT, IBM, Microsoft), followed by courses in Spanish by the Spanish-speaking institutions. Most of the favourite courses are focused on Excel and programming languages like Python and R to work with data, and programming languages, tools very in demand in the business world. These data are similar to the most popular courses mentioned in the 2021 Coursera Impact report (Yu X. et al. 2021). Excel and computer programming appear in the first positions of trending skills in several categories.

RQ3: Does the experience increase the knowledge about the potential of MOOCs among the university community?

Data reveal that most of the UPV community members had no knowledge or experience with MOOCs. Considering that several emails informing about the initiative were sent to all university community members and that around 23% participated in the initiative, data conclude that the experience increased the awareness of MOOC potential in the community.

But global data from some years ago were very similar to the ones we get on this experience. In a survey sent to human resource staff of 103 North Carolina organisations by RTI and Duke University, only 31% answered that they had heard of MOOCs before the survey (Radford

2015). In a survey in Georgia in 2014, 61% of the students had never heard about MOOCs or taken one of them (Muzafarova & Kaya, 2015). At the same moment, in a 2016 study in Nepal, 78% of students had never heard about MOOCs (Shakya et al., 2016).

This reality points out one of the main problems of MOOCs: they are unknown by the general public. If these courses were so unknown among the UPV community –the biggest Spanish speaker provider of MOOCs–, the situation in other institutions with less participation in MOOCs and outside HE could be even worse.

RQ4: Is the use of MOOCs in a massive open way a satisfactory experience for participants?

A 33% completion rate in the UPV experience exceeds over 4 times the 7% average completion rate reported by Khalil&Ebner (2014), or the 7,7% average completion rate for HarvardX and MITx courses reported by Chuang & Ho (2016), and almost 7 times the 4.65% completion rate of the course studied by Ruipérez-Valiente et al. (2017).

The completion rate for certificate paying is not as high as the 60% completion rate for certificate paying students reported by Chuang & Ho (2016) for edX courses or the 56,7% reported by Goli et al. (2019) for Coursera. Still, it is similar to the 47% completion rate of certificate track for a MOOC on edX where free coupons for certificates were offered and the 41% completion rate for the certificate-paying students of other MOOCs, both reported by Littenberg-Tobias et al. (2020).

According to qualitative and quantitative data, we can conclude that the initiative was perceived as valuable for the University's community. Users were very satisfied with it and rated high the quality of the courses. UPV community also believes that the knowledge they acquire with MOOCs will be valuable for their professional career (3.67/5), which is in line with the 71% of learners from Coursera that report career benefits (Yu X. et al. 2021).

RQ5: Under what conditions would participants use MOOCs and certifications in the future?

The vast majority of the UPV community that participates in the survey declared they will take a MOOC in the future, and they think it is worth paying for the verified certificate of a MOOC. The main reason to join the initiative was to gain a new professional skill. The main factors that would make them pay for a MOOC are the course subject and the institution that created the MOOC.

It is noticeable that the main reason to take the courses is the same reported by Breslow et al. (2013) –on their study regarding the first MOOC offered by MIT on edX–, and Bayeck (2016) in an exploratory study of MOOC learner's demographics. But in their study about MOOC use among those who cannot afford formal education, Dillahunt, Wang & Teasley (2014) found that the main reason for taking MOOCs was general interest in the topic, with around 80% of the answers of their survey mentioning it. With around 60% of the answers, professional development was "just" in the second position.

Some notes for the future

The final reflection of the participation of the UPV community in this initiative is mainly positive. UPV members were very happy with the initiative of providing them free certificates for the MOOCs; they consider the quality of the MOOCs they took as very good and think they will help improve their professional careers. MOOCs are perceived as a good tool for professional training.

Despite the limitations of the study we present, the case study results indicate that MOOCs are an excellent tool for professional education in higher-ed and that users value the certificates. But it is important to remark the immense ignorance about the existence of these courses, which would be at the base of some problems cited frequently about MOOCs. They are being used by already educated people (Hansen&Reich, 2015). This situation and the gap gender in MOOCs access that mirror the gap gender in technical universities –at least following the Spanish figures–remark the importance of doing general campaigns for making broader and more democratic the real access to MOOCs.

Given the success of the UPV courses among the UPV community members, and, as edX gives its members the possibility to offer free codes for their courses to their communities, UPV set up a follow-up initiative to distribute codes UPV courses to UPV members. The university has created a new website using the same system used on the initiative, in which the community members can ask for up to 5 codes for edX courses. When writing this article, 1 year after setting up the new service, 3,048 codes had been sent to UPV students, staff and faculty, and 774 certificates had been granted.

UPV has also joined a follow-up initiative of edX called RAP, which offers free certificates of 145 courses to HE institutions around the world until July 2022 (edX, 2020). The mechanism of this new edition is different; edX provides a license to each participant that gives access to the certificates of all included courses. At the moment of writing this article, 2,324 licenses have been distributed by UPV, and participants have obtained 1024 certificates with them.

Our results emphasise the importance of thinking on MOOCs –as in any initiative regarding the digital transformation of universities or educational institutions– not just as a punctual resource, but as a strategical investment (Castañeda, Esteve_Mon & Postigo_Fuentes, In press) that would not only impact on the institutional teaching offer but in professionally developing its staff, and on the social compromise of the institutions (Papadimitriou, 2020; Adell, Castañeda & Esteve-Mon, 2018), for critical moments as the CoVid-19 crisis, but also beyond them. Governments could finance the certificates of MOOCs to help close the digital gap inside the working institutions and the retraining of the workforce needed (Illanes et al. 2018). Still, there is a need to invest in spreading the word about them to the general public.

Abbreviations
MOOC Massive Open Online Courses
HE Higher Education
MIT Massachusetts Institute of Technology
RAP Remote Access Program
UPV Universitat Politècnica de València
RQ Research Question

Availability of data and materials
The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy regulations.

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The authors declare that they have no competing interests.

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4.3. RESULTADOS DEL ANÁLISIS DE LA INICIATIVA DESDE EL PUNTO DE VISTA DE LOS ALUMNOS EN GENERAL

Se ha realizado un estudio de la demografía y características del uso de los MOOC por los más de 2,7 millones de usuarios únicos de la iniciativa y de las más de 77.000 respuestas al cuestionario de satisfacción. Dicho estudio está todavía en revisión en el momento de redactar esta tesis, con lo que no ha sido incluido como artículo en el listado del compendio, pero los datos recopilados y las conclusiones extraídas son muy interesantes para el objetivo de esta tesis, por lo que se incluye el estudio en este apartado.

Esta investigación da respuesta también al tercer objetivo de la tesis:

3. Estudio del proceso desde el punto de vista de los estudiantes:
    - 3.1. Describir las características del estudiantado que ha participado en la iniciativa y el uso que han hecho de los MOOC
    - 3.2. Conocer la opinión de los alumnos sobre la iniciativa y los cursos
    - 3.3. Indagar si, tras conocer la iniciativa, están dispuestos a hacer más MOOC en el futuro y a pagar por sus certificados
    - 3.4. Analizar e identificar los focos de mejora identificados por los estudiantes

INVESTIGACIÓN: "10 años de iniciativa MOOC en la Universitat Politècnica de València. Perfiles, preferencias y satisfacción del estudiantado"

Despujol, I., Castañeda, L., y Turró, C. (2022). 10 años de iniciativa MOOC en la Universitat Politècnica de València. Perfiles, preferencias y satisfacción del estudiantado. En revisión.

10 años de iniciativa MOOC en la Universitat Politècnica de València. Perfiles, preferencias y satisfacción del estudiantado

Ignacio Despujol, *Miembro Senior, IEEE,* Linda Castañeda, Carlos Turró

***Resumen*—Se analizan los perfiles, las preferencias y los datos de satisfacción de los más de 2,7 millones de usuarios únicos de los MOOC (Cursos masivos, abiertos y en línea) que la Universitat Politècnica de València ofrece desde enero de 2013 en diversas plataformas (edx, miriadax y upvx). Las estadísticas de la plataforma muestran una demografía similar a la reportada en otros estudios (usuarios entre 25 y 35 años, con título universitario y más hombres que mujeres), que hay un estancamiento en los últimos años en la inscripción y que las medidas adoptadas por edX para conseguir la sostenibilidad han decrementado el número de aprobados e incrementado las ventas de certificados. También muestran que las temáticas más solicitadas son los idiomas y cursos sobre herramientas útiles en el trabajo. Las respuestas a la encuesta de satisfacción muestran que los usuarios están contentos con la iniciativa (3,92/5 en expectativas cubiertas), con los cursos y con las plataformas, que les parece adecuada una duración de 3 a 10 minutos para los vídeos docentes y que les parecen suficientes las opciones de resolución de dudas ofertadas por la UPV, así como que dedican 3 horas semanales de media a seguir los cursos.**

***Palabras clave*— MOOC, Educación en línea, OER, satisfacción**

I. INTRODUCCIÓN

EL término curso abierto masivo en línea (MOOC) fue creado por David Comier y Bryan Alexander en 2008 para dar nombre a un curso conectivista experimental en el que 2.000 internautas aprendían trabajando de forma colaborativa online [1] y se popularizó a finales de 2011 cuando Daphne Koller y Andrew Ng, de la Universidad de Stanford, lanzaron una serie de cursos online en los que se inscribieron cientos de miles de personas [2]. Desde entonces han crecido mucho, llegando a superar los 220 millones de inscripciones en más de 19.400 cursos de 950 universidades de todo el mundo [3] y haciendo de los MOOC una de las apuestas de uso de la tecnología en Educación Superior que tiene un mayor impacto a nivel internacional.

Sin embargo, en la literatura especializada solo aparecen estudios parciales de algunos de los aspectos de las experiencias educativas que han usado MOOC de una forma continuada a lo largo de estos años, como el estudio de los inscritos en la iniciativa Telescope y su participación en la misma [4], la descripción de SAWYAM, la iniciativa MOOC de la India [5] o los estudios recogidos en la revisión de literatura sobre la iniciativa MOOC de Malasia [6]. Un repaso de las revisiones de literatura publicadas sobre MOOCs [7][8][9][10][11] permite comprobar que no incluyen aproximaciones globales que analicen las iniciativas que se ponen en marcha desde los diferentes ámbitos de la complejidad propia de la Educación Superior.

La Universitat Politècnica de València (UPV) comenzó con los MOOC en enero de 2013 con 2 cursos en una plataforma propia, upvx.es, y, desde entonces, ha publicado sus cursos en 3 plataformas (upvx.es, miriadax.net y edx.org) usando 3 tecnologías (Google Course Builder, MiriadaX y Open edX) [12]. Actualmente tiene más de 100 cursos de muy diversas temáticas, alojados en edx.org y upvx.es (también basada en Open edX), habiendo lanzado más de 600 ediciones de esos cursos en las que se han realizado casi cuatro millones de inscripciones. Estas cifras convierten a su iniciativa MOOC en una de las mayores de habla hispana a nivel mundial [13].

Este trabajo forma parte de un estudio global de esa iniciativa que pretende analizarla desde varias perspectivas: administrativa, tecnológica y de implementación docente [12], de implementación en tiempos de crisis [14] [15], y también desde un análisis pormenorizado de instructores [16] y participantes.

Así pues, este artículo pretende caracterizar a los más de dos millones setecientos mil participantes únicos inscritos en las distintas plataformas de la UPV, estudiando sus datos demográficos, los cursos en los que más se inscriben y los porcentajes de estudiantes aprobados y que optan por pagar un certificado. Además, se cuenta con datos de percepción de más de 75.000 participantes, que nos habla de su satisfacción con la experiencia. Con ello se pretende terminar de perfilar y proporcionar una visión de conjunto sobre una iniciativa de gran tamaño y consolidada en el tiempo que pueda servir de ayuda a otras instituciones e investigadores.

La organización del trabajo es la siguiente: La sección II presenta un estado del arte de la literatura sobre los MOOCs en educación superior (ES). La sección III describe el contexto del estudio y las preguntas de investigación. La sección IV presenta la metodología, incluyendo la recopilación y el análisis de datos, y la sección V presenta los resultados. Finalmente, se presentan las conclusiones, su discusión y las limitaciones del estudio.

Uso de los MOOC en la educación superior

El éxito de inscripciones en el lanzamiento de los MOOC de la Universidad de Stanford en 2012 llamó la atención de los medios, que llegaron a publicar que 2012 era el "año del MOOC" [17], incluso calificándolos como la tecnología educativa más importante de los últimos 200 años [18].

Pero el formato que se impuso, denominado x-MOOCs, y basado en lecciones repartidas en vídeos cortos y preguntas de tipo test y numéricas para reforzar los contenidos y evaluar la progresión del alumno [19], no introduce ninguna innovación pedagógica sobre la educación tradicional, requiriendo además de la autorregulación del alumno para el seguimiento del curso, por lo que pronto aparecieron autores críticos con el nuevo sistema [20], de los que alguno llegó a afirmar que el interés que habían suscitado desaparecería en el futuro [21].

También se publicaron artículos apuntando a los principales problemas del modelo desarrollado: la falta de un modelo de sostenibilidad a largo plazo, la necesidad de generar credenciales con valor reconocido en el mercado de la educación y el empleo, las bajas tasas de finalización y la falta de un sistema remoto de autenticación y control del estudiante en los exámenes que fuera realmente escalable [22].

A pesar de estos problemas, que siguen vigentes en la actualidad, el movimiento MOOC ha seguido creciendo de forma ininterrumpida hasta el momento actual, con un salto importante durante los confinamientos forzados por la pandemia de COVID-19, habiéndose superado los 220 millones de inscripciones a finales de 2020 [3]. En sus inicios, los MOOC empezaron como una forma de compartir conocimiento que ofrecía certificados gratuitos sin valor académico, pero en el proceso recorrido por las grandes plataformas para intentar convertirlos en una iniciativa viable (y, en cada vez más casos, en un negocio lucrativo), se han ido acercando cada vez más hacia el modelo de negocio de la educación continua en línea de postgrado, situando parte de su contenido tras una pasarela de pago [23] y ofreciendo micro-credenciales de pago con acceso a créditos académicos [24]. Así, en 2016 edX creo los Micromasters, que proporcionan crédito académico si el alumno continúa luego en un máster, y Coursera siguió el mismo camino en 2018 con los Master tracks [25]. A finales de 2021 las plataformas MOOC ofrecían ya más de 1650 micro-credenciales [3].

Dado su éxito, los MOOC han generado una gran cantidad de literatura científica, y, a finales de 2020, más de 4000 registros incluían la palabra clave MOOC en su título o en su abstract al realizar una búsqueda en la base de datos de la Web of Science [26], existiendo un gran número de revisiones de literatura sobre el tema desde 2013 [7] hasta la actualidad.

En muchas de estas revisiones se identifica la caracterización de los estudiantes, sus problemas, inquietudes y nivel de satisfacción como uno de los temas más tratados en la literatura científica [8][9][10][11], algo razonable, pues se trata de la perspectiva humana y más deseable del impacto de esta disrupción tecnológica en algo que es un servicio público.

I. La iniciativa mooc de la UPV

La UPV es una universidad tecnológica española de tamaño medio [27]. En el curso 2020/2021 tuvo 28.450 estudiantes matriculados en 13 escuelas, facultades y una escuela de doctorado [28]. Los grados y másteres impartidos por la UPV son principalmente técnicos, existiendo una facultad de administración y dirección de empresas y una de bellas artes, además de las escuelas de ingeniería y arquitectura [28].

Desde que lanzó su iniciativa MOOC en 2013, la UPV ha utilizado los MOOCs como una palanca estratégica para impulsar su transformación digital [12], creando en 2013 su propia plataforma MOOC

(upvx.es) usando una tecnología de código abierto de Google llamada Course Builder.

A finales de 2014, la UPV se unió a edx.org, una de las dos principales plataformas MOOC mundiales [3] pero decidió conservar upvx.es para lanzar las primeras ediciones de los cursos nuevos y mantener en ella aquellos cursos de ámbito local o que tuvieran algún problema para ser trasladados a edX [12]. En total ha lanzado más de 670 ediciones de 130 MOOCs diferentes –la mayoría en español– con casi 4 millones de inscripciones en total [16].

Así pues, la UPV es una de las universidades con mayor producción de MOOCs en español, siendo líder de la oferta en español de edX, con más de 100 cursos y 3,7 millones de inscripciones en esta plataforma en el momento de escribir este artículo [29].

La UPV optó por un modelo X-MOOC [19], con cursos basados en vídeos cortos de teoría de entre 2 y 10 minutos con una pregunta corta de refuerzo tras cada vídeo, agrupados en módulos semanales, con un examen para cada módulo y un examen final basados en preguntas tipo test, de respuesta numérica o de respuesta de texto corto. Todos los cursos cuentan con un foro en el que los estudiantes pueden comunicarse con el equipo del curso y entre ellos.

Los profesores pueden proponer MOOCs que se salgan del modelo anterior, siempre que la plataforma open edX soporte sus propuestas. Esto hace que, aunque la mayoría de cursos siguen el modelo estándar, haya cursos con ejercicios de arrastrar y colocar, con actividades de corrección por pares o por el equipo del curso basadas en rúbricas, con laboratorios interactivos, con reproductores y grabadores de audio para que el estudiantado practique pronunciación, con emuladores de software para realizar los ejercicios y cursos que hacen uso de licencias gratuitas de software específico para que el estudiantado practique y realice los exámenes.

Para la creación de MOOC la UPV tiene una comisión que recibe y aprueba las propuestas de nuevos MOOCs de su comunidad (cualquier empleado puede presentar una) y, una vez se aprueban, se pone en contacto a los promotores con el departamento de creación de MOOCs.

Hay una convocatoria anual que incentiva la creación de materiales digitales de aprendizaje, dando a los profesores una pequeña cantidad de dinero y puntos de actividad académica si se presenta el MOOC [30]. Esta misma convocatoria proporciona a los profesores algunos puntos adicionales de actividad académica por la supervisión de un MOOC cada vez que se publica una nueva edición.

La UPV ha desarrollado un sistema sencillo de grabación de vídeo denominado Polimedia, que el profesor puede reservar usando la red informática de la universidad [31], y el departamento de soporte a los MOOC ofrece a los profesores la posibilidad de encargarse de la creación del MOOC en la plataforma de edX, de forma que puedan concentrarse en el diseño del contenido y su desarrollo en formatos estándar (Polimedia y Excel y Word para la estructura) o involucrarse en el diseño del MOOC todo lo que deseen [12].

El departamento MOOC tiene también un grupo común de estudiantes asistentes que se encarga de atender los foros de todos los cursos en marcha, supervisando las preguntas realizadas y enviando a los profesores solo aquellas que requieran de su intervención [12].

La UPV ha creado un total de 130 cursos desde el arranque de la iniciativa MOOC. Algunos de estos cursos han sido discontinuados, pero la mayoría siguen en marcha, habiendo ofrecido 100 cursos distintos en 2021.

EdX comenzó ofreciendo un certificado gratuito a aquellos estudiantes que aprobaran los cursos, denominado certificado de código de honor, además de un certificado verificado de pago, modelo que también seguían MiriadaX y otras grandes plataformas de MOOC. upvX ofrecía una credencial sin validez académica similar al certificado gratuito. En diciembre de 2015 edX anunció que dejaba de

entregar certificados gratuitos y dejaba solo los certificados de pago para mejorar la sostenibilidad de la plataforma [32] y upvX retiró las credenciales gratuitas.

Como la media anterior no fue suficiente para conseguir la sostenibilidad económica, en diciembre de 2018 edX anunció que, en adelante, los exámenes de los cursos solo estarían disponibles para los estudiantes que pagaran el certificado, y que los estudiantes de acceso gratuito dejaban de tener acceso ilimitado al curso, perdiendo el acceso a su contenido cuando se cumplieran las semanas de duración del MOOC [33]. Ambas medidas cambiaron la forma en que los estudiantes consumían los MOOC de edX, que, a partir de la segunda medida, perdieron la condición de curso gratuito con evaluación para convertirse en un repositorio de contenido educativo de acceso temporal si no se paga el certificado. Para intentar que los MOOC sigan teniendo entidad como cursos, la UPV ha ido añadiendo a muchos de ellos exámenes de prueba no evaluables accesibles al estudiantado que no paga. Además, de acuerdo con su función social, la UPV solicitó a edX que sus cursos de materias básicas universitarias mantuvieran el modelo gratuito anterior, manteniendo sus exámenes abiertos para los participantes que no pagan, además del acceso a su contenido al pasar las semanas de duración del curso.

La mayoría de los cursos ofrecidos por la UPV están en español (97), aunque hay una oferta significativa en inglés (31, un 24%) y algún curso suelto en valenciano (3) y francés (1).

En edx.org los cursos pueden agruparse en unidades superiores de diversos tipos, dependiendo de su orientación profesional y de si proporcionan créditos académicos para continuar en una titulación de las universidades socias [34]. La UPV ofrece 11 certificaciones profesionales propias (4 de ellas en inglés), 4 certificaciones profesionales en conjunto con otras universidades, 1 micromáster (que proporciona créditos para un máster propio) y 3 programas X-Series (agrupaciones sin orientación profesional).

Las temáticas de los cursos son muy diversas, desde cursos de valenciano en upvx.es, hasta cursos de Introducción a Python o Ciencia de datos y aprendizaje automático en edx.org, pasando por cursos de Despoblación rural o Inmunología. La siguiente tabla con los programas ofertados en edX da una idea de esta diversidad.

Investigación Tabla 1

Programa	Tipo	Cursos	Idioma
Liderazgo y trabajo en equipo en grupos de mejora continua	Micromáster	4	español
Marketing digital y redes	Certif. profesional	2	español
Power Bi para los negocios	Certif. profesional	2	español
Excel para los negocios	Certif. profesional	3	español
Fundamentos de Microsoft Office para la empresa	Certif. profesional	3	español
Herramientas TIC para la educación	Certif. profesional	3	español
Fundamentos TIC para profesionales de negocios	Certif. profesional	5	español
Arquitectura sostenible: Evaluación interdisciplinar	Certif. profesional	2	español
Habilidades esenciales de Liderazgo	Cert. prof. conjunta	2	español
Herramientas de presentación: Power Point, Photoshop e Illustrator	Cert. prof. conjunta	3	español
Gestión de proyectos y metodología ágil	Cert. prof. conjunta	2	español
Fitness corporativo: nutrición y bienestar laboral	Cert. prof. conjunta	2	español
Bases matemáticas para estudiar ingeniería	X-Series	3	español
Fundamentos de Química	X-Series	8	español

Fundamentos de Física para ingeniería	X-Series	3	español
Basic Spanish	Certif. profesional	3	inglés
Upper-Intermediate English	Certif. profesional	4	inglés
Interdisciplinary Sustainable Architecture Assessment	Certif. profesional	2	inglés
IT Fundamentals for Business Professionals	Certif. profesional	5	inglés

La duración recomendada de los cursos es de 4 a 8 semanas, aunque son los profesores los que eligen la duración de sus cursos. En las primeras ediciones los cursos empezaron siendo más largos, con algún curso de hasta 16 semanas, pero la experiencia en la gestión ha demostrado que es mejor que los cursos sean cortos para que el estudiantado pueda acabarlos, con lo que la mayoría de los cursos iniciales más largos han sido divididos en 2 o 3 MOOCs más cortos. En 2021 el curso más corto fue de 2 semanas y el más largo de 10. La duración media de los MOOC de la UPV pasó de 6,85 semanas en 2013 a 5,16 semanas en 2021.

II. Metodología

II.1 Objetivo del estudio y preguntas de investigación

El objetivo de este artículo es estudiar de forma pormenorizada a los estudiantes de la iniciativa MOOC de la UPV, caracterizándoles, identificando sus elecciones y perspectiva sobre los cursos en los que han participado y sobre los distintos aspectos de la iniciativa MOOC.

Para alcanzarlo se definen 7 preguntas de investigación:

P1- ¿Cuáles son los principales datos demográficos de los participantes de la iniciativa MOOC de la UPV?

P2- ¿Cómo han evolucionado las inscripciones, aprobados y compras de certificados con el tiempo?

P3- ¿Cuáles son las temáticas más elegidas por los participantes y por las que más están dispuestos a pagar?

P4- ¿Qué opinan los participantes de la iniciativa MOOC de la UPV, de los cursos hechos y de las plataformas?

P5- ¿Les parece a los participantes adecuado que los vídeos docentes duren entre 3 y 10 minutos?

P6- ¿El soporte en foros con un grupo común de estudiantes ayudantes les parece suficiente a las personas que participan?

P7- ¿Cuánto tiempo dedican a la semana las personas que participan para el seguimiento de los MOOC?

II.2 Tipo de estudio

La investigación se ha realizado como un estudio de caso, ya que este modelo permite desarrollar una comprensión profunda y polifacética de un tema complejo en su contexto de la vida real [35]. Este caso de estudio se considera evaluativo, pero con un enfoque descriptivo [36].

Instrumentos de recogida de datos:

El estudio incluye la narrativa del equipo que desarrolló la implementación de la experiencia y utiliza 2 fuentes de datos: las bases de datos de las plataformas MOOC de la UPV para obtener los datos de

demografía (número de inscritos, número de estudiantes que pagan certificados y número de estudiantes que aprueban), y una encuesta para obtener una descripción detallada de las percepciones de los participantes sobre su experiencia.

Las preguntas P1 a P3 se responderán con datos de las plataformas y P4 a P7 con la encuesta de satisfacción.

La encuesta incluyó la recopilación de:

-Información sobre el motivo de inscribirse en el MOOC

-Información sobre si completaron el curso o no y la causa

-Valoración del nivel del curso respecto a sus conocimientos previos

-Valoración del sistema de aprendizaje utilizado

-Valoración de frecuencia de publicación y ritmo del curso

-Valoración de la duración de los vídeos

-Valoración de la calidad del contenido de los vídeos

-Valoración de los exámenes y actividades

-Valoración de las opciones de resolución de dudas

-Valoración del aprendizaje obtenido con el curso

-Grado de cumplimiento de las expectativas de 0 a 5

-Horas invertidas a la semana para hacer el curso

-Valoración de la velocidad de respuesta de la plataforma

-Evaluación de problemas encontrados usando la plataforma

-Valoración de la comodidad de la plataforma

-Navegadores usados para seguir el curso

-Respuesta abierta sobre qué mejoraría de la plataforma

II.3 Recolección de datos

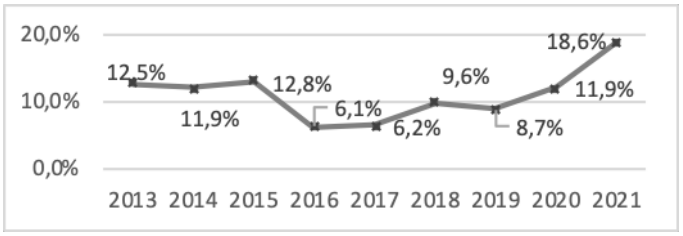
La información demográfica y de participación se ha obtenido directamente de las bases de datos de las plataformas MOOC y la encuesta se ha enviado por correo electrónico a los participantes siguiendo un procedimiento que ha ido cambiando. En las primeras ediciones de upvX y edX y en la de MiriadaX, los cursos estaban abiertos unas pocas semanas o, a lo sumo, uno o dos meses, con lo que las encuestas de satisfacción se mandaban al cerrar los cursos y tenían una tasa de respuesta aceptable.

A partir de 2015 la mayoría de los cursos pasaron a estar abiertos durante todo el año en modo a ritmo del usuario, con lo que no se podía esperar a acabar la edición para mandar las encuestas. Se creó un ciclo de envío de encuestas cada 3 meses que, en muchos casos, y dada la saturación del equipo,

llega a ser cada 4 o 5 meses, con lo que muchos participantes hace mucho tiempo que habían acabado o dejado el curso cuando les llega la encuesta. Esto, sumando al cambio de política de edX en diciembre de 2018, comentado en un apartado anterior, hace que la proporción de respuestas a las encuestas enviadas en las últimas ediciones sea menor.

Se han recibido 77.085 respuestas con información en alguno de los campos. Un 68,4% son relativas a cursos realizados en edX, un 20,4% a cursos realizados en upvX y un 11,1% a cursos realizados en MiriadaX.

Como se observa en la figura 1, la distribución de las respuestas recibidas por años es bastante uniforme, con un pico en 2020-2021 que coindice con el pico de inscripciones durante la pandemia.



Investigación Figura 1. Distribución de las respuestas por años

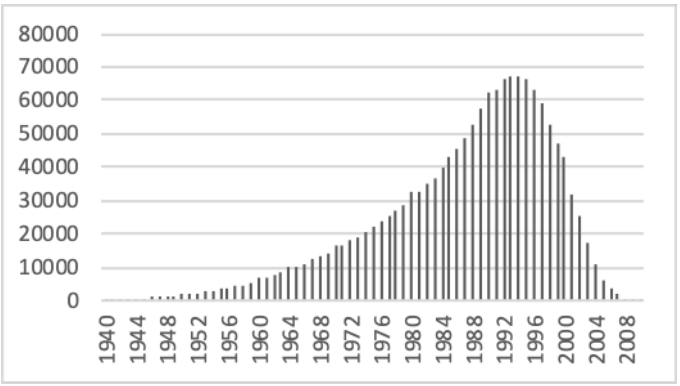
III. Resultados

III.1 Demografía

Se dispone de datos de 2.641.662 participantes únicos, la mayoría de edx.org (93,2%), un 5,3% de participantes de upvx.es y un 1,5% de participantes de MiriadaX.

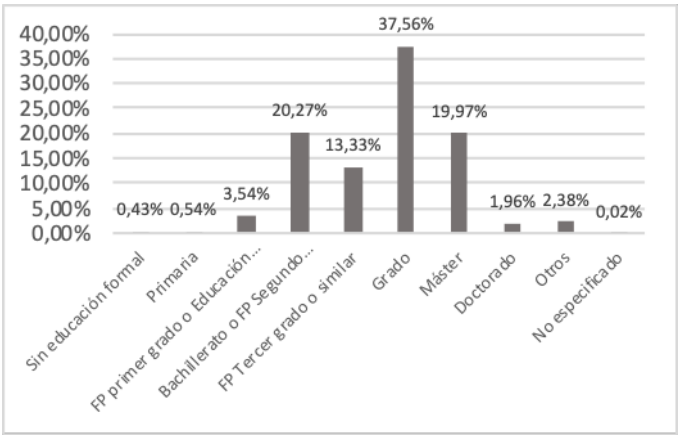
El primer parámetro demográfico consultado a los inscritos es su género, que está bastante equilibrado, siendo un 54,4% hombres, un 45,2% mujeres y un 0,4% de participantes que se identifican como otros.

Con respecto al año de nacimiento la moda es 1994 y la media 1986,7, lo que nos da una edad media de 35,3 años y una edad más habitual de 28 años. En la figura 2 se puede ver la distribución de años de nacimiento.



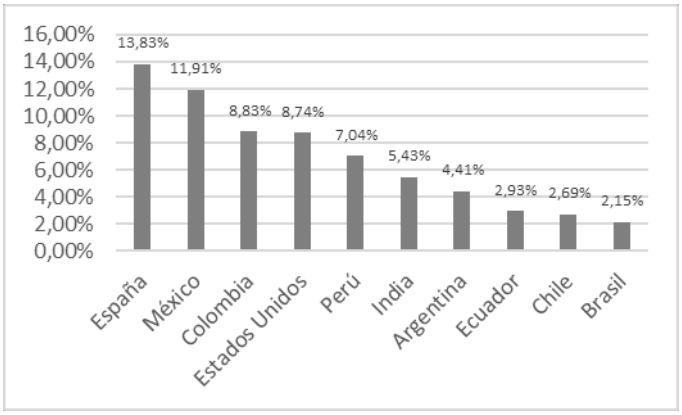
Investigación Figura 2. Año de nacimiento de los inscritos

Observando el nivel de educación de los inscritos en la figura 3, tenemos que el 59,5% tenían educación universitaria (el 37,6% un grado, el 20% un máster y el 2% un doctorado), con un porcentaje muy bajo sin educación formal o con educación primaria (aproximadamente el 1% en total).



Investigación Figura 3. Nivel de educación de los inscritos

Atendiendo al país de origen de los inscritos tenemos que, aunque hay inscripciones de 240 países o territorios distintos, los 10 primeros países concentran el 68% de los inscritos. En la figura 4 podemos ver que España está en primer lugar con un 13,8%, seguida por México con un 11,9% y Colombia con un 8,8%. Estados Unidos aparece como cuarto país con un 8,7%, luego Perú con un 7% y luego India con un 5,4%. Los inscritos de Estados Unidos e India provienen principalmente de los cursos de español básico realizados en inglés, apareciendo también representados entre los 20 primeros países Reino Unido (1,3%), Turquía (1,1%), Canadá y Egipto (con un 1% cada uno) y Filipinas (0,8%).



Investigación Figura 4. Principales países de origen

Un dato demográfico que también merece la pena comentar es el dom inio de las direcciones de correo de los inscritos, pues el 64,2% son direcciones de gmail.com. el 13,7% de hotmail.com, el 3% de yahoo.com y el 1,53% de outlook.com.

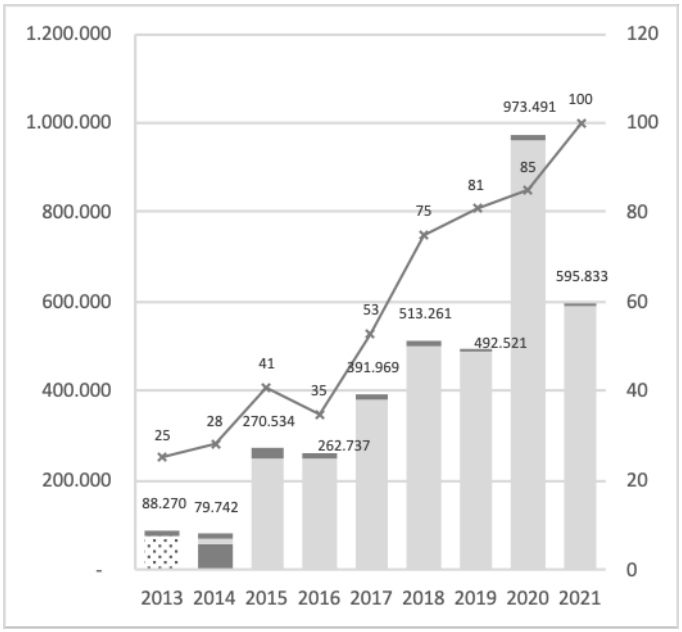
Las direcciones de correo de la propia universidad (del dominio upv.es) suponen el 3,8% de los inscritos, pudiendo observarse también dominios significativos de universidades latinoamericanas, como el 0,11% de unal.edu.co con 2967 inscritos, el 0,1% de dos dominios de pcup.edu.pe con 2722 inscritos, el 0,07% de misena.edu.co con 1948 inscritos o el 0,05% de unicauca.edu con 1229 inscritos, entre otros.

III.2 Inscripciones, aprobados y certificados comprados

Hay 3.839.065 inscripciones registradas en la base de datos (el 93,5% de la plataforma edx.org, el 4,5% de la plataforma upvx.es y el 2% de la plataforma MiriadaX.net). Esto supone que el número de MOOCs que ha realizado un usuario en promedio son 1,5.

Si observamos la distribución temporal de las inscripciones totales en la figura 5, donde aparecen las inscripciones totales en la etiqueta y las inscripciones en las distintas plataformas en los colores y tramas

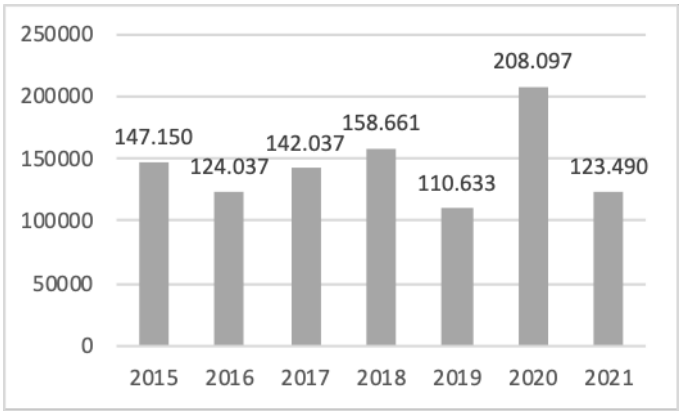
apilados de las barras (MiriadaX con trama, upvx oscuro y edx claro), vemos que en 2014 las ediciones en las distintas versiones de upvX igualaron prácticamente la inscripción en la edición de MiriadaX en 2013 y que, a partir de 2015, la inscripción se disparó con la entrada en edX, creciendo hasta 2018, momento en que se estabilizó a pesar de que siguió creciendo la oferta de cursos (representada con una línea con unidades sobre el eje secundario de la derecha del gráfico), observándose una caída de inscripciones de 2018 a 2019. En 2020, con los confinamientos decretados por la pandemia generada por la COVID-19, las inscripciones se dispararon, volviendo en 2021 a un nivel parecido al previo a la pandemia, con un ligero crecimiento.



Investigación Figura 5. Inscripciones por año y por plataforma

La evolución de las inscripciones en upvX no se aprecia en la gráfica por su pequeña escala comparada con las de edX. Las inscripciones en esta plataforma tuvieron un pico en 2014 en 73.000 inscritos antes de la entrada en edX. El año siguiente bajaron a algo más de 20.000 y después cayeron a alrededor de 13.000 inscritos en 2016 y 2017, bajando a 10.500 inscritos en 2018 y luego al entorno de 7.000 inscritos en 2019 y 2021, con un pico de 10.000 inscritos en 2020 por la pandemia.

Si, para estudiar la tendencia de las inscripciones eliminando el efecto de la introducción de nuevos cursos, seleccionamos solamente los datos de los 25 cursos que llevan en funcionamiento desde 2015, tenemos la figura 6, en la que se observa una caída de inscritos de 2015 a 2016, que se recupera en 2017 para continuar con tendencia creciente en 2018 y una bajada en 2019, que se ve interrumpida en 2020 por la pandemia, pero que vuelve a aparecer en 2021.



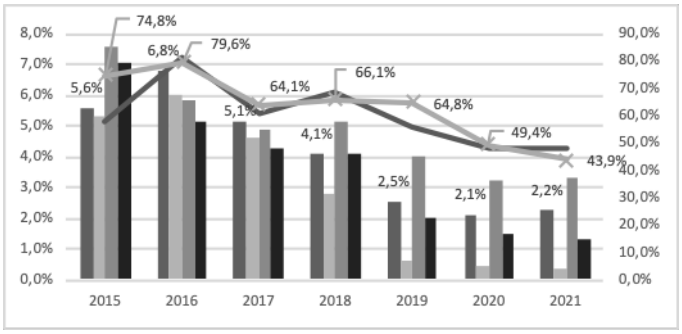
Investigación Figura 6. Inscripciones por año en los cursos que llevan desde 2015

En upvX los únicos cursos que se han mantenido en el tiempo desde el principio son los de valenciano nivel C, que tuvieron un pico de inscripciones en 2017 y una bajada posterior.

III.3 Aprobados

El porcentaje de aprobados es muy distinto entre los participantes que pagan el certificado y los participantes que se inscriben en el curso de forma gratuita. Esto es todavía más acusado a partir de 2019, momento en el que los participantes que no pagan en edX dejaron de poder acceder a los exámenes y, por tanto, poder aprobar el curso (excepto en los 17 cursos de materias básicas que la UPV mantienen en el modelo anterior).

En la figura 7 se representan con barras sobre el eje izquierdo 4 series de datos, ordenadas de izquierda a derecha: el % de aprobados totales en todos los cursos, el % de aprobados de no pago en todos los cursos, el % de aprobados totales en los 25 cursos que tienen ediciones todos los años y el % de aprobados de no pago en esos cursos. Con líneas y sobre el eje izquierdo se representan los % de aprobados de pago en todos los cursos (color oscuro) y en los 25 con ediciones todos los años (claro). Solo se ha puesto la leyenda con los % de la primera serie de barras y la de línea clara.



Investigación Figura 7. Aprobados totales, de no pago y de pago para todos y 25 cursos

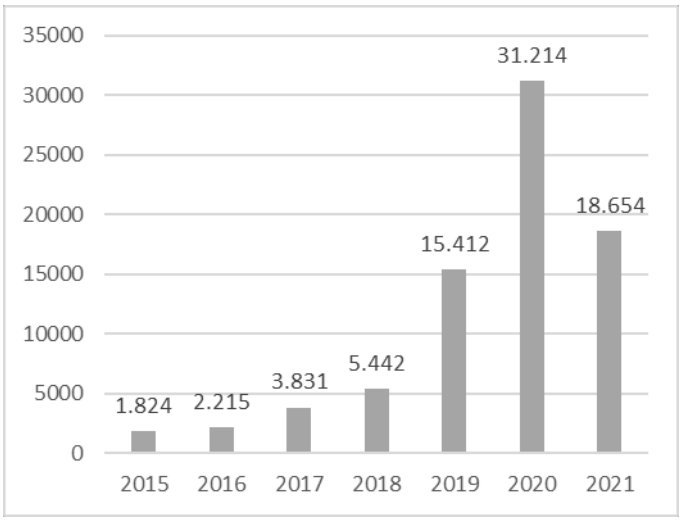
Se puede apreciar que el % de aprobados de pago ha ido bajando con los años, pero se mantiene elevado, entre el 75% y el 43% y que el % de aprobados generales y gratuitos ha bajado drásticamente a partir de 2018, desapareciendo prácticamente los aprobados gratuitos de casi todos los cursos (en los 25 cursos se ha mantenido algo porque hay mayor proporción de cursos que siguen en el modelo anterior para los inscritos gratis).

En MiriadaX el % de aprobados fue del 15,4% y en upvX la media de todos los años está en 12,4%.

III.4 Certificados comprados

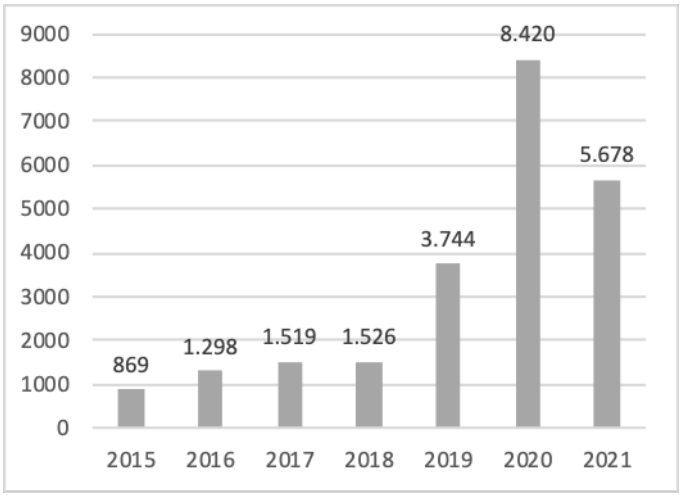
Se ha obtenido el número de certificados vendidos por año descontando los comprados por un gran cliente corporativo para un proyecto específico, pues es un hecho puntual que distorsiona la observación de la evolución anual de la venta de certificados.

En la figura 8 se puede observar que hubo un salto significativo en la venta de certificados de 2018 a 2019, luego hubo otro gran salto de 2019 a 2020 por la pandemia, llegando a duplicarse, y en 2021 la venta de certificados volvió a niveles de 2019 pero con un incremento de casi un 20%.
Figura 8. Ventas de certificados por año



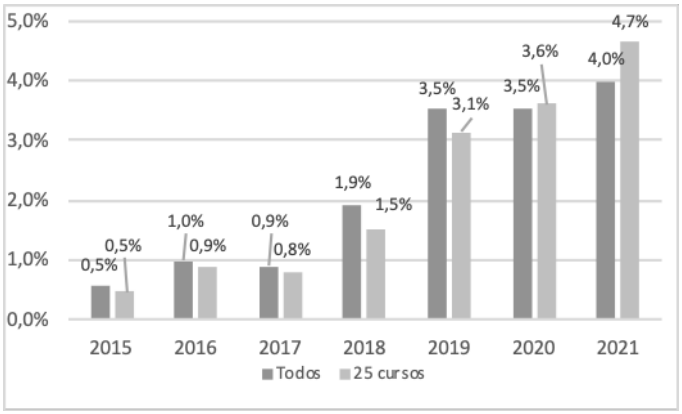
Investigación Figura 8. Ventas de certificados por años

Si seleccionamos solamente los datos de los 25 cursos que llevan en funcionamiento desde 2015, para estudiar la tendencia de las inscripciones eliminando el efecto de la introducción de nuevos cursos, tenemos la figura 9, en la que se observa una tendencia similar sin tanta diferencia entre las ventas de los años 2018 y 2019 y sin crecimiento entre las ventas de 2019 y 2021.



Investigación Figura 9. Ventas de certificados por año de los 25 cursos que llevan desde 2015

Si representamos los mismos datos como porcentaje de los datos globales obtenemos la figura 10, donde se observa que el porcentaje se multiplica por 2,5 de 2017 a 2018 y por 1,4 de 2018 a 2019 para todos los cursos, manteniéndose en los años posteriores. Se observa también que, si consideramos los datos de los 25 cursos en funcionamiento desde 2015 (color claro), para eliminar el efecto de la introducción de nuevos cursos, el porcentaje es prácticamente el mismo.



Investigación Figura 10. Porcentaje de certificados verificados

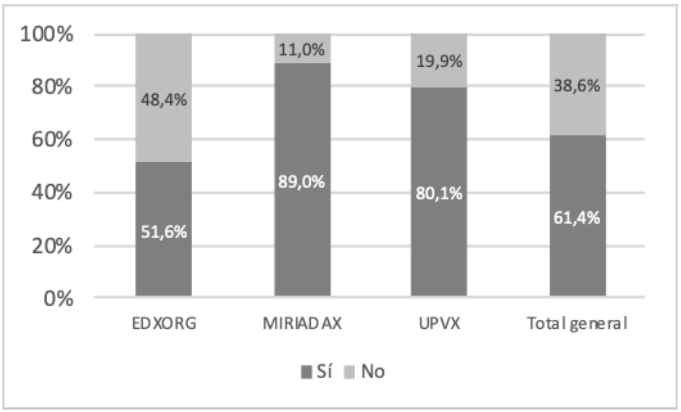
III.5 Temáticas más solicitadas

Los cursos con más inscritos son los tres dedicados a la enseñanza del español básico (con 711.125 inscripciones en total), los 3 de Excel (671.944 en total), los 4 de inglés intermedio nivel B2 (434.000 en total), el de introducción a la gestión de proyectos (133.261), el de introducción a la programación en Android (112.118), el de introducción a la bolsa (100.062), el de aprender a comer sano (74.137) y el de introducción a la programación en Python (72.881), que suman en total más de la mitad de las inscripciones.

Los cursos con más certificados comprados (sin contar el cliente corporativo mayoritario) son los tres dedicados a la enseñanza del español básico (con 18.042 en total), los 3 de Excel (41.987 en total), los 4 de inglés intermedio nivel B2 (3.388 en total), el de introducción a la gestión de proyectos (5.179), el de introducción a la programación en Android (112.118), el de introducción a la bolsa (2.214), el ODS y la Agenda 2030 (2.031) y el de introducción a la programación en Python (2.009).

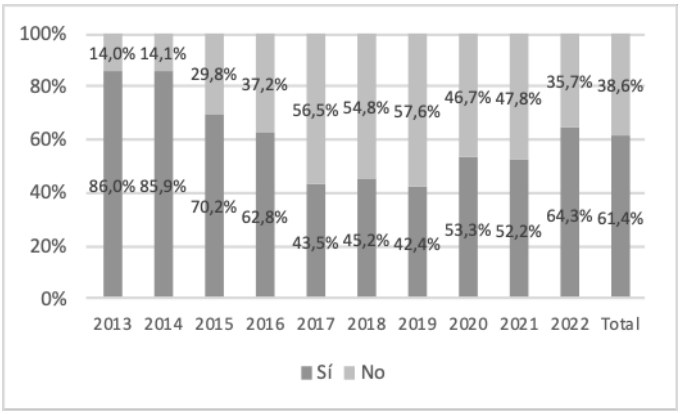
III.6 Resultados de la encuesta, satisfacción general

La primera pregunta que se incluye en el estudio es si los participantes terminaron o no el curso y, si no terminaron, cuál fue la razón. En la figura 11 se observa que la mayoría de los que contestaron la encuesta habían acabado los cursos, aunque hay un porcentaje significativo (sobre todo en edX, donde es casi la mitad) que no.



Investigación Figura 11. Finalización o no de los cursos

Si representamos esta misma información por años en la figura 12 vemos que, al principio, el porcentaje de respuestas de participantes que han acabado el curso es muy alto (pues coincide con las ediciones de MiriadaX y upvX) y que luego en 2017, 2018 y 2019 el porcentaje de participantes que no han acabado el curso supera al de los que sí. A partir de 2019 en edX los participantes que no pagan no pueden acceder a los exámenes y, por lo tanto, no pueden completar el curso, pero sigue habiendo un porcentaje significativo de respuestas de participantes que no han acabado el curso.



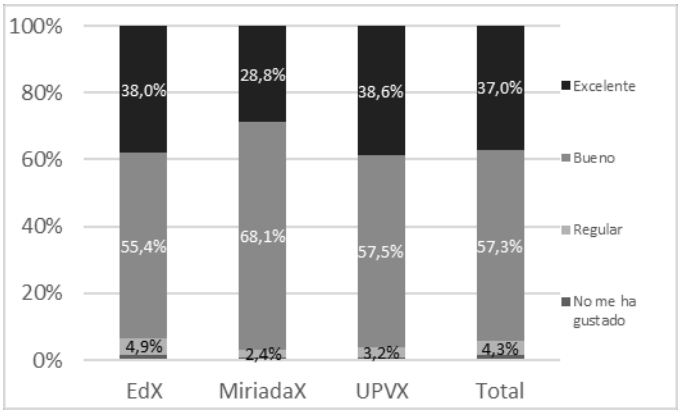
Investigación Figura 12. Finalización o no de los cursos por años

En la tabla 2 se reflejan los porcentajes de cada una de las razones para no haber acabado el curso, estando la falta de tiempo siempre por encima del 80%. La segunda causa de abandono es la falta de interés en completar el curso (sobre todo en edx.org) y la tercera los fallos de la plataforma.

Investigación Tabla 2 Razones para no acabar el curso

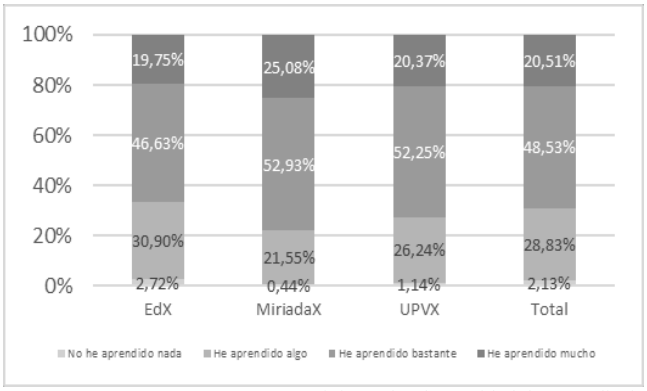
RAZÓN	EDXORG	MIRIADAX	UPVX	Total general
No	0,0%	0,0%	1,9%	0,2%
No, el nivel del curso era demasiado alto	1,8%	0,0%	2,1%	1,8%
No, el nivel del curso era demasiado bajo	1,5%	0,0%	1,0%	1,4%
No, la calidad del curso me ha decepcionado	2,2%	1,7%	1,7%	2,1%
No, los fallos de la plataforma me han hecho abandonar	5,4%	7,8%	4,3%	5,3%
No, no he tenido tiempo	81,7%	89,0%	84,8%	82,3%
No, no me interesaba el contenido	0,8%	0,4%	0,8%	0,7%
No, sólo me inscribí para verlo	6,6%	1,1%	3,5%	6,1%

En la figura 13 se observa la valoración del sistema de aprendizaje por parte de los participantes. Sumando las respuestas "Excelente. Me ha parecido casi perfecto" (37%) y "Bueno. Aunque se podría mejorar en varios aspectos" (57%) se obtienen más del 94% de las respuestas totales, frente a "Regular. Me va a costar mucho trabajo adaptarme a esta forma de aprender" (4,3%) y "No me ha gustado nada" (1,3%).



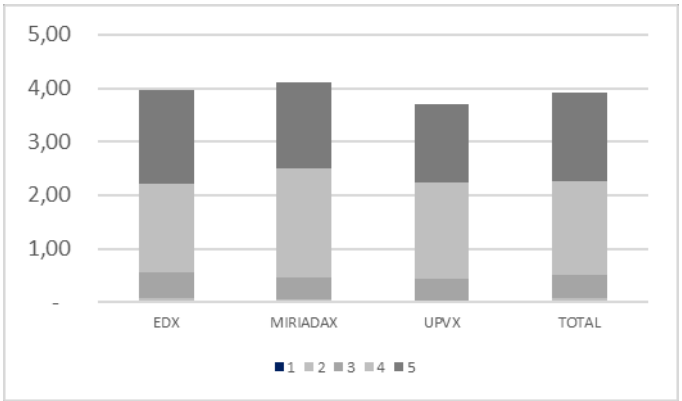
Investigación Figura 13. Opinión sobre el sistema de aprendizaje

En la siguiente pregunta los participantes evaluaron cuánto creían que habían aprendido con los cursos realizados. En la figura 14 se observa que en todos los casos las opciones de "He aprendido mucho" y "He aprendido bastante" superan el 66% frente al 2,72% máximo del "No he aprendido nada".

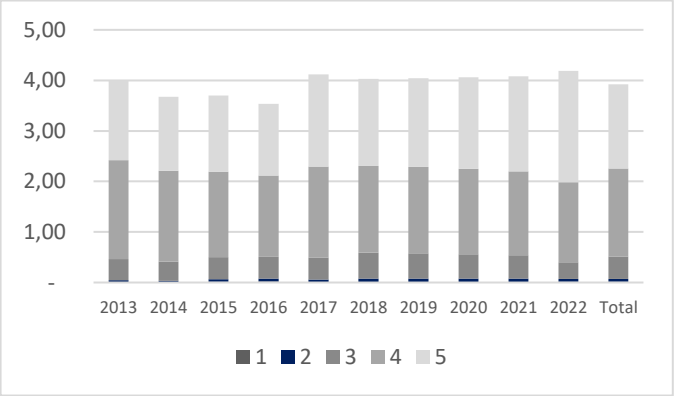


Investigación Figura 14. Opinión sobre la cantidad de aprendizaje

En la siguiente pregunta se pidió a los participantes que valoraran de 0 a 5 cuánto habían cubierto sus expectativas los cursos que habían seguido. En la figura 15 se ha representado para cada plataforma la cifra obtenida de multiplicar el número de respuestas por cada valoración, con la contribución de cada segmento, obteniéndose un valor de 3,92 sobre 5 como media total, con una mayoría de respuestas de 4 o 5. En la figura 16 podemos ver la evolución de este parámetro a lo largo del tiempo, pudiendo observarse que la valoración ha mejorado ligeramente en los últimos años.



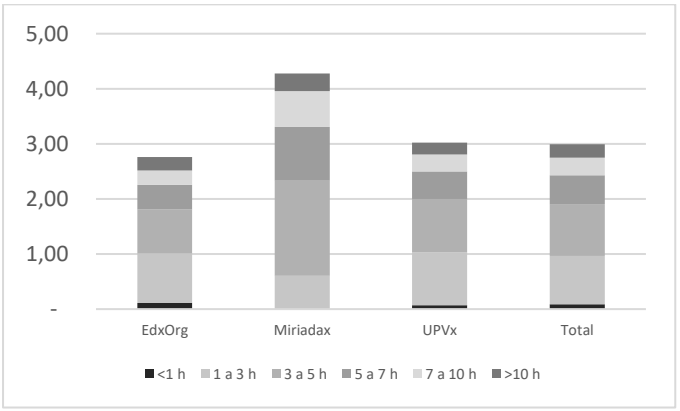
Investigación Figura 15. Cumplimiento de expectativas sobre 5



Investigación Figura 16. Evolución temporal del cumplimiento de expectativas sobre 5

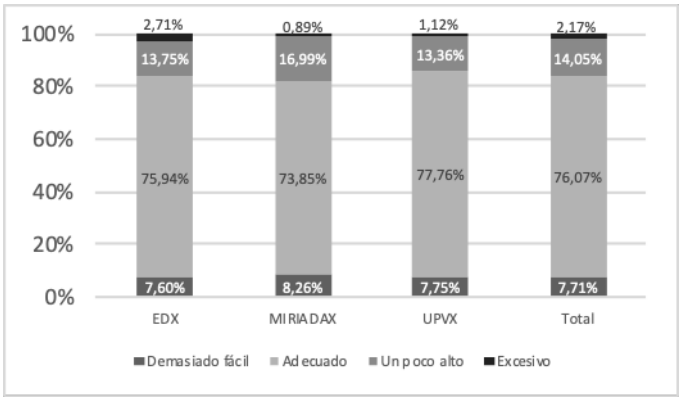
III.7 Resultados de la encuesta, Opinión sobre los cursos

La primera pregunta analizada se refiere al número de horas semanales dedicadas al seguimiento del curso. En la figura 17 se ha representado para cada plataforma la cifra obtenida de multiplicar el número de respuestas por la media del intervalo (utilizando 12 para el intervalo de más de 10 horas), obteniéndose un valor de 3,00 sobre 5 como media total, siendo este valor de 2,76 para la plataforma edX, valores bastante inferiores a la media de dedicación requerida declarada en los cursos, que es de 4,53 horas semanales.



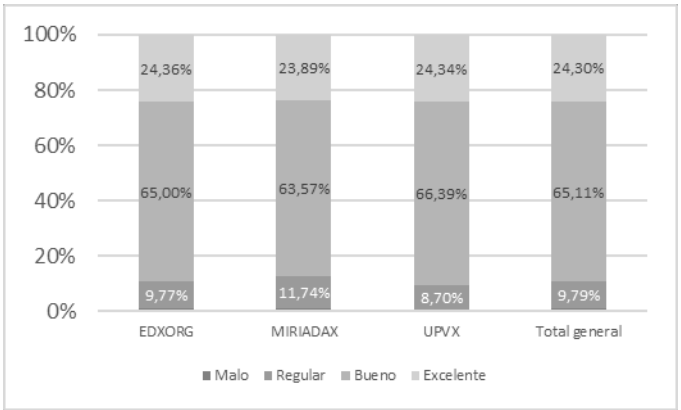
Investigación Figura 17. Media de dedicación semanal por plataforma

En la figura 18 podemos ver el resumen de las respuestas a la pregunta sobre el nivel de los cursos, constatando que a la mayoría de los participantes este les parece adecuado o un poco alto (con el 88,11% de las respuestas totales, frente a un 7,71% de los participantes a los que les parece fácil y un 2,71% a los que les parece difícil) y que estos valores son muy similares entre las distintas plataformas.



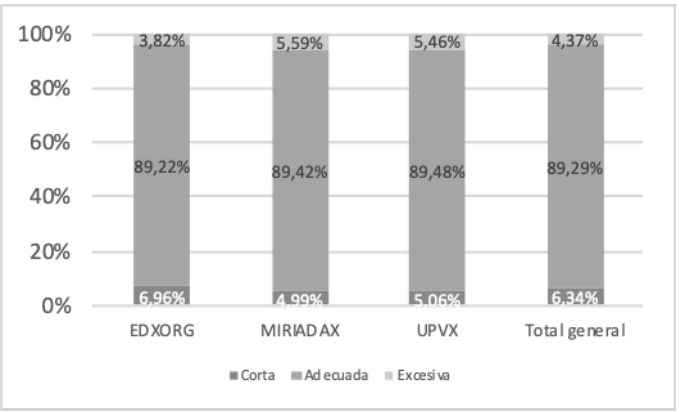
Investigación Figura 18. Opinión sobre el nivel del curso con respecto a sus conocimientos

En la figura 19 observamos la respuesta a la pregunta sobre la calidad del contenido de los vídeos, con un 89,4% de los participantes totales que opinan que el contenido de los vídeos es bueno o excelente, frente a un 0,8% que opinan que es malo. Estos valores son también muy similares entre plataformas.



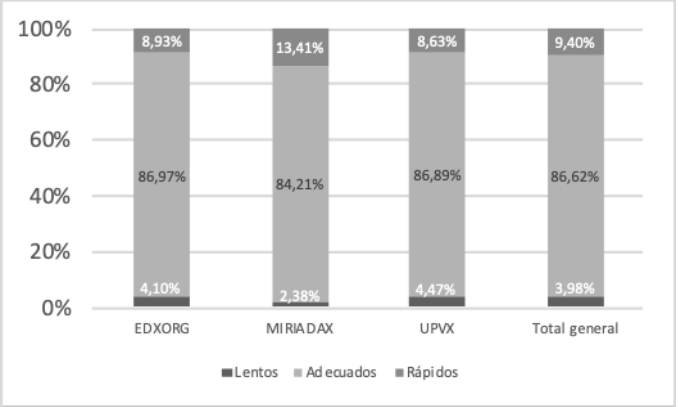
Investigación Figura 19. Opinión sobre el contenido de los vídeos

En la figura 20 tenemos la opinión de los participantes sobre la duración de los vídeos, con un 89,3% que opinan que es adecuada y un reparto bastante similar entre los que opinan que es corta (6,34%) o excesiva (4,37%). La opinión es uniforme en las distintas plataformas.



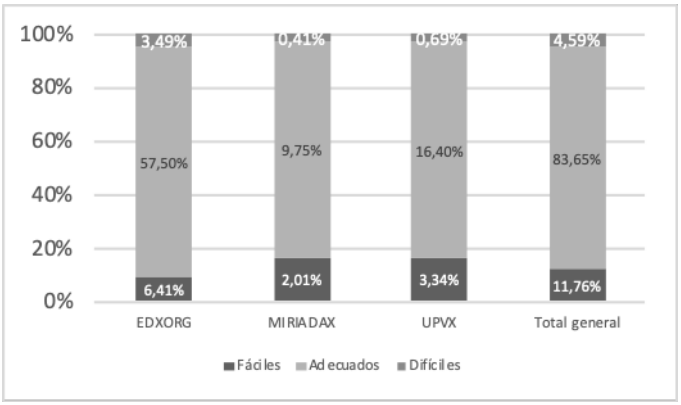
Investigación Figura 20. Opinión sobre la duración de los vídeos

En la figura 21 se puede ver que a un 86,6% de los participantes les pareció que el ritmo de publicación de contenidos fue adecuado, con un 9,4% que lo consideraron rápido y un 3,98% lento. Los datos son uniformes entre las distintas plataformas.



Investigación Figura 21. Opinión sobre el ritmo de publicación de los contenidos

Las respuestas a la pregunta sobre el nivel de los exámenes se resumen en la figura 22, donde puede verse que el 83,85% de los participantes consideraron que eran adecuados, con un 11,76% que opinaron que eran fáciles y un 4,59% difíciles.

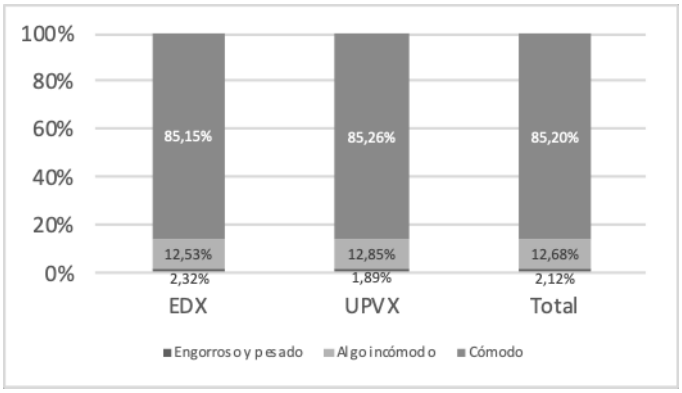


Investigación Figura 22. Opinión sobre el nivel de los exámenes

III.8 Resultados de la encuesta, Opinión sobre la plataforma

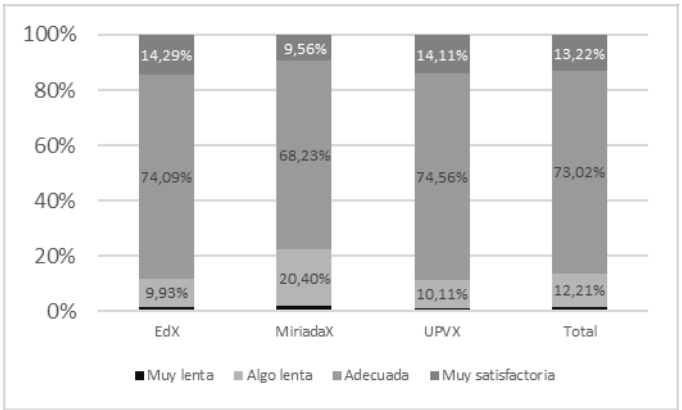
El último bloque de preguntas está dedicado a conocer la opinión de los participantes sobre la plataforma.

La primera pregunta se refiere a la usabilidad de la plataforma (no se incluyó para MiriadaX). En la figura 23 se puede observar que el 85,2% de los participantes consideraron que usar la plataforma era cómodo, con solo un 2,12% de los participantes que consideraron que era engorroso y pesado.



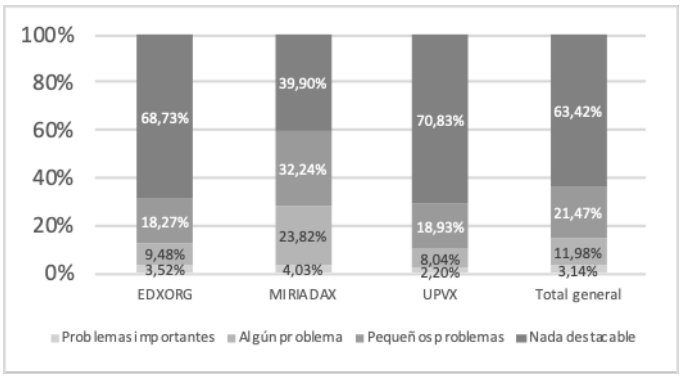
Investigación Figura 23. Opinión sobre la usabilidad de la plataforma

En la siguiente pregunta se consultó a los participantes sobre la velocidad de respuesta de la plataforma. En la figura 24 se observa que el 86,24% de los participantes globales la consideraron adecuada o muy satisfactoria y que solo en MiriadaX parece que hubo algún problema adicional.



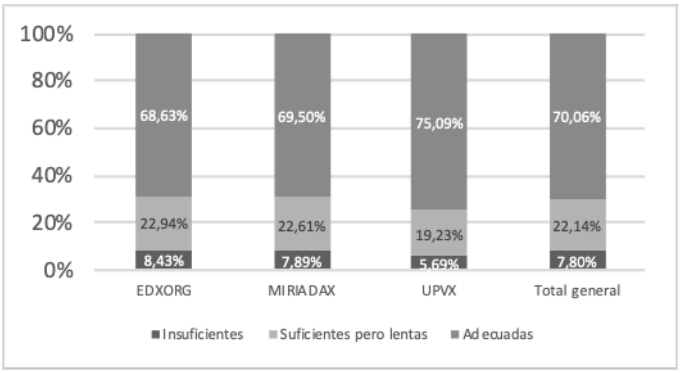
Investigación Figura 24. Velocidad de la plataforma

En la figura 25 se pueden ver las respuestas sobre si los participantes tuvieron problemas con la plataforma y se observa que más del 85% de los participantes reportaron que o no tuvieron problemas o fueron pocos, excepto en MiriadaX.



Investigación Figura 25. Problemas con la plataforma

En la figura 26 se ve que el 70% de los participantes encontraron adecuado el sistema de resolución de dudas.



Investigación Figura 26. Opinión sobre el sistema de resolución de dudas

IV. Limitaciones

Este estudio tiene dos limitaciones importantes, la primera es que se basa en los datos de una sola institución, aunque sea una iniciativa de tamaño importante y el estudio sea bastante exhaustivo, lo que hace que cualquier generalización deba llevarse a cabo teniéndolo en cuenta. Y la segunda es que la encuesta se basa en una muestra no obtenida de forma sistematizada para representar adecuadamente la población, lo que hace difícil realizar determinado tipo de análisis. A pesar de estas limitaciones, el tamaño de la iniciativa, su extensión en el tiempo y la cantidad de datos estudiados lo convierten en una herramienta útil para cualquiera que quiera estudiar los MOOC o esté involucrado en una iniciativa similar.

V. Discusión

Respondiendo a la primera pregunta de investigación, los datos demográficos son parecidos a los de otras iniciativas web, con una media de edad de 35,5 años y una moda de 28, lo que coincide con los datos reportados en el estudio de los 4 primeros años de MOOC en Harvard y el MIT [37], la media de 28 años reportada por Guo y Reinecke [38] en su estudio, y el rango de edad más común incluido en el macro-estudio de proveedores regionales y globales de MOOC [39]. El porcentaje del 59,7% de estudiantes con educación superior (grado, máster o doctorado) es parecido, e incluso algo menor, que los reportados en los estudios anteriores. Se observa una participación más paritaria –45,2% de mujeres– que las reportadas en otros estudios como el 33% de mujeres reportado por Chuang y Ho [37] o entre el 14% y el 44% encontrados por Guo y Reinecke [38] en su estudio, pero sin llegar a igualarse la participación de hombres y mujeres.

En conclusión, se puede decir que los cursos de la UPV atraen a la misma población de participantes con formación universitaria y en la primera parte de su carrera profesional, con mayoría de hombres, que las demás iniciativas (solo que en este caso más de países hispanohablantes como España, México o Colombia). La procedencia de los inscritos es el parámetro que más ha variado con respecto al primer estudio publicado por la UPV sobre el tema [40], pues el ingreso en edX ha hecho que la proporción de estudiantes españoles disminuya en gran medida.

Para responder a la segunda pregunta se puede concluir que las inscripciones en los cursos tuvieron una tendencia creciente muy fuerte de 2016 a 2018 desde el ingreso en edX hasta el año 2018, donde se estancaron. Se observa una caída de 2015 a 2016, muy probablemente debida a la desaparición de los certificados gratuitos a finales de 2015 y también una fuerte subida en 2020 debida a los confinamientos por el COVID-19, pero en 2021 vuelve a aparecer el estancamiento, debido, probablemente, a la gran diversificación de la oferta MOOC que se ha producido en los últimos años [3]. Es interesante constatar que aún hay un desconocimiento muy grande del fenómeno MOOC entre el público en general [15], con lo que las plataformas MOOC deberían redoblar sus esfuerzos en dar a conocer su oferta al gran público.

En lo relativo al porcentaje de aprobados se constata la gran diferencia entre los que pagan los certificados, cuyos porcentajes de finalización están rondando el 50% los últimos años y en años anteriores llegaron al 75% (muy probablemente las iniciativas de edX ofreciendo certificados gratis hayan tenido una influencia en la bajada de este porcentaje en 2020 y 2021, pues los porcentajes se acercan a los reportados por Littenberg-Tobias y otros [41]) y los porcentajes de aprobados entre los que se inscriben de forma gratuita, que en los primeros años se movían entre el 5 y el 6%, en línea con lo reportado en otros estudios, tanto para estudiantes de pago [37][42] como para los de ruta gratuita [37][43][44]. Como era de esperar, la medida tomada por edX a finales de 2018 para mejorar su sostenibilidad tuvo un impacto muy negativo en el porcentaje de estudiantes de no pago que aprueban los cursos.

Con respecto a upvX, que no ofrece certificados de ningún tipo, el porcentaje de aprobados se ha movido entorno al 12,4%, algo inferior al 15,4% de MiriadaX en 2013.

En lo relativo a las ventas de certificados, se observa que la medida tomada por edX a finales de 2018 sí tuvo un efecto significativo en la venta de certificados, suponiendo los confinamientos un nuevo tirón (distorsionado por las ofertas de certificados gratuitos de edX para instituciones de educación superior cuyos efectos que pueden observarse en el apartado dedicado a las direcciones de correo de las inscripciones) y manteniéndose una tendencia positiva después de la pandemia (impulsada, posiblemente, por la bajada de precios de los certificados de los cursos en español que fomentó edX en 2020).

Como respuesta a la tercera pregunta de investigación podemos decir que las temáticas más demandadas, tanto para inscribirse, como para pagar los certificados, tienen que ver con el aprendizaje

de idiomas y de habilidades específicas para el puesto de trabajo, como el Excel o la gestión de proyectos, lo que está en línea con las tendencias mencionadas en el último reporte de impacto de Coursera publicado [45].

Las más de 75.000 respuestas a la encuesta final indican que los participantes de la iniciativa de la UPV indican que los participantes están contentos con el sistema de aprendizaje basado en MOOCs (más del 93% valoran el sistema como excelente o bueno), creen que aprenden con los cursos (66% han aprendido bastante o mucho) y creen que los cursos han cubierto sus expectativas (con una media de casi 4 sobre 5, un valor algo inferior al reportado por Coursera de 4,7 [45]). La razón alegada por los participantes para no haber terminado los cursos es, en más del 80% de los casos, la falta de tiempo.

Los participantes también reportan estar contentos con los cursos y con las plataformas utilizadas, con una satisfacción con la plataforma algo menor en la edición de MiriadaX.

Con respecto a la pregunta sobre la opinión sobre la idoneidad de la duración de los vídeos de entre 3 y 10 minutos para aprender, a casi el 90% de los participantes le parece que la duración es adecuada, estando bastante equilibradas las respuestas que opinan que es corta (6,34%) o excesiva (4,37%), lo que indica que no hay un desbalanceo excesivo hacia una de las opciones.

La respuesta a la pregunta sobre la opinión sobre el soporte en foros, realizado por un grupo común de estudiantes asistentes en primer nivel, lo que descarga mucho a los docentes, puede ser muy interesante para los gestores de iniciativas similares, ya que 70% de los participantes consideran que el soporte fue adecuado y el 22% que fue suficiente pero lento, con solo el 7,8% que opinan que fue insuficiente.

En la respuesta a la última pregunta de investigación se aprecia que, aunque los diseñadores de los MOOC crean los cursos con cargas de 4 o 5 horas semanales como objetivo (la media publicada de dedicación los MOOC de la UPV está en 4,53 horas a la semana), cada estudiante le dedica unas 3 horas a la semana al seguimiento de los cursos, algo que debe ser tenido muy en cuenta a la hora de diseñar nuevos MOOC.

VI. Conclusión

Se ha realizado una descripción general del estudiantado de los MOOC de la UPV, de sus preferencias y de su opinión sobre la iniciativa, los cursos y las plataformas usadas, estudiando aspectos concretos que pueden ser de utilidad para investigadores y gestores de iniciativas similares. Los datos disponibles permiten realizar análisis parciales mucho más exhaustivos y profundizar en temas como la influencia de los cambios de política de edX en el porcentaje de aprobados y los certificados vendidos, las causas de las distintas tendencias temporales, el punto de vista de los participantes sobre cursos o temáticas concretas, o la clasificación de los participantes según su intención de acabar (siguiendo el modelo propuesto en [46]). Además, los más de 10.000 comentarios recibidos en el campo de respuesta libre pueden ser analizados de forma cualitativa para extraer conclusiones más profundas. Todo esto queda para trabajos de investigación futuros.

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CAPÍTULO 5. CONCLUSIONES

CONTENIDOS DEL CAPÍTULO

5.1. CONCLUSIONES GENERALES

En esta tesis se ha realizado un estudio de la iniciativa MOOC de la UPV teniendo en cuenta los puntos de vista de los principales implicados

.

En el artículo I se ha dado respuesta al **Objetivo 1:** "Estudio del proceso desde el punto de vista técnico/administrativo", documentando en profundidad el proceso técnico/administrativo y de toma de decisiones que siguió la UPV para poner en marcha la plataforma MOOC.

Se ha constatado que la universidad ha conseguido todos los objetivos iniciales principales que se propuso (conseguir reputación digital e impacto publicitario en los medios y fomentar el uso de las tecnologías de la información en la docencia reglada dando visibilidad a los profesores que han hecho MOOCs) con una inversión y unos gastos pequeños para la magnitud de la tarea acometida. Gran parte del éxito se debe a la realización de un estudio previo para crear una estructura de soporte muy eficiente.

La pertenencia a edx.org es una gran herramienta de reputación y permite a la UPV ser parte de una comunidad que está influyendo en gran medida en el futuro de los MOOC, y haber mantenido su propia plataforma OpenedX se ha demostrado una buena elección para mantener la independencia, experimentar y garantizar que la iniciativa pueda continuar sin depender de ninguna organización externa (Zancanaro, Nunez y Dominguez, 2017). La UPV ha demostrado que se puede mantener una iniciativa MOOC con éxito con un coste marginal teniendo un grupo de profesores motivados y entrenados, dejándoles hacer los cursos que elijan y soportándolos con los procedimientos y herramientas de producción adecuadas. En el momento de redactar el artículo no estaba claro si la iniciativa podía llegar a ser sostenible económicamente, pero, con los cambios que se han incorporado a posteriori, actualmente está a punto de conseguir la sostenibilidad, que es uno de los problemas identificados en el artículo.

En el artículo IV se ha dado respuesta al **Objetivo 2:** "Estudio del proceso desde el punto de vista del profesorado", recogiendo las opiniones de casi todos los docentes implicados (79) y documentando sus motivos para hacer cursos y los problemas que tienen al crearlos, recogiendo sus sugerencias de mejora.

En el artículo se observa que las motivaciones de los docentes son principalmente intrínsecas (según la teoría de 2 factores de Herzberg, 2003), siendo llegar a más gente, compartir conocimiento, aprender nuevas pedagogías, contribuir a la educación abierta o el desafío personal los factores de motivación más importantes, lo que está alineado con el estudio hecho por Young Doo et al. (2020) que agrupa los factores motivacionales en 7 categorías y señala las 4 categorías relacionadas con los factores intrínsecos como las más importantes. Pero, a su vez, los profesores señalan la falta de reconocimiento institucional como un problema importante, lo que según Herzberg es un factor higiénico (extrínseco) importante que, si no se soluciona, puede llevar a los profesores a perder su interés en los MOOC (lo que se puede apreciar en algunas de las respuestas a la pregunta de respuesta abierta) y que se recoge también en otros estudios (Zheng et al., 2016).

En el estudio se puede constatar que un porcentaje importante de los profesores ha recibido poca formación sobre la creación de MOOC. Siendo bajo el porcentaje de profesores de la UPV que han recibido formación es el doble de los que reportan otros estudios (Young Doo et al., 2020).

Otros factores motivacionales de importancia para los instructores han sido la creación de marca personal e institucional y la posibilidad de mostrar su trabajo, algo que también está en línea con lo señalado en el estudio de Young Doo et al. (2020). Estos factores motivacionales, que no son excluyentes, deberían ser tenidos en cuenta por las instituciones

para diseñar sus estrategias MOOC.

Los mayores beneficios para su carrera profesional mencionados por los profesores están relacionados con la mejora de su docencia, junto al compromiso social y a la reputación profesional. Los profesores también comentan que los MOOC les han ayudado a incorporar el paradigma online a sus otras actividades docentes.

Las respuestas de los docentes dejan claro que la formación en nuevas tecnologías y pedagogías para el nuevo entorno online son claves para que las instituciones de educación superior tengan éxito en un futuro que ya no es tan lejano y que las redes de profesores son un instrumento muy potente para la incorporación a las nuevas tecnologías, por lo que las instituciones deberían tener estrategias para fomentarlas y aprovecharlas al máximo. Esto es algo que coincide con los hallazgos del estudio de Young Doo et al. (2020).

Con respecto a qué conocimientos les gustaría adquirir los docentes mencionaron habilidades técnicas para la producción de contenidos, pedagogía online y habilidades de presentación, lo que también coincide con los hallazgos de Young Doo et al. (2020).

Los profesores mostraron su satisfacción con el proceso de soporte durante la creación e impartición de los MOOC, lo que probablemente hizo que no haya menciones en sus respuestas a problemas con el escalado, las incógnitas masivas o las crisis reputacionales mencionadas en el estudio de Zheng et al. (2016). Sus quejas principales están relacionadas con el poco reconocimiento de la universidad a esta actividad (la UPV da un reconocimiento en forma de puntos para los informes de productividad anual, pero es un reconocimiento pequeño para el esfuerzo requerido), demandado la mayoría de ellos reducción en las horas de docencia tradicional. En un segundo grupo de demandas aparece la solicitud de más recursos para el desarrollo de los cursos (ya sea más soporte del equipo, más recursos para desarrollo de materiales o para promover los cursos). Estas demandas coinciden con las constatadas en estudios previos relativos al desarrollo de implementaciones digitales en instituciones de educación superior (Castañeda et al., 2022).

La respuesta de los profesores a sí merece la pena el haber creado los MOOC es unánime, sí les ha merecido la pena y el pequeño incentivo monetario que da la universidad ha tenido mucho menos que ver que el disponer de un soporte fuerte y proactivo que les ayuda en la creación y desarrollo de los cursos.

Las conclusiones de este segundo artículo confirman y extienden los hallazgos de los dos estudios más importantes existentes sobre las motivaciones y preocupaciones de los profesores (Young Doo et al., 2020 and Zheng et al, 2016). Además, resaltan la importancia de que las instituciones dispongan de una aproximación estratégica a los MOOC como la de la UPV, tanto para incrementar las oportunidades de expansión y reconocimiento internacional, como para conseguir una percepción interna positiva y que se involucren los profesores (Illanes et al. 2018, Papadimitriou, 2020; Castañeda, et al., 2022).

En la investigación que está en revisión se ha dado respuesta al **Objetivo 3:** “Estudio del proceso desde el punto de vista de los estudiantes”, describiendo las características del estudiantado que participa en los cursos, sus opiniones y sugerencias de mejora y estudiando los cursos que más seleccionan.

Los datos demográficos de los inscritos son parecidos a los de otras iniciativas web, con una media de edad de 35,5 años y una moda de 28, lo que coincide con los datos reportados en el estudio de los 4 primeros años de MOOC en Harvard y el MIT (Chuang y Ho, 2016), la media de 28 años reportada por Guo y Reinecke (2014) en su estudio, y el rango de edad más común incluido en el macro-estudio de proveedores regionales y globales de MOOC (Ruipérez-Valiente et al., 2020). El porcentaje del 59,7% de estudiantes con educación superior (grado, máster o doctorado) es parecido, e incluso algo menor, que los reportados en los estudios anteriores. Se observa una participación más paritaria –45,2%

de mujeres– que las reportadas en otros estudios como el 33% de mujeres reportado por Chuang y Ho (2016) o entre el 14% y el 44% encontrados por Guo y Reinecke (2014) en su estudio, pero sin llegar a igualarse la participación de hombres y mujeres.

En conclusión, se puede decir que los cursos de la UPV atraen a la misma población de participantes con formación universitaria y en la primera parte de su carrera profesional, con mayoría de hombres, que las demás iniciativas (solo que en este caso más de países hispanohablantes como España, México o Colombia). La procedencia de los inscritos es el parámetro que más ha variado con respecto al primer estudio publicado por la UPV sobre el tema (Despujol, Turró & Busquets, 2014), pues el ingreso en edX ha hecho que la proporción de estudiantes españoles disminuya en gran medida.

Las inscripciones en los cursos crecieron de forma muy significativa desde 2016 a 2018, donde se estancaron. Hubo una caída de 2015 a 2016, muy probablemente debida a la desaparición de los certificados gratuitos a finales de 2015 en edX y también una fuerte subida en 2020 debida a los confinamientos por el COVID-19, pero en 2021 apareció de nuevo el estancamiento, debido, probablemente, a la gran diversificación de la oferta MOOC que se ha producido en los últimos años (Shah, 2021).

En lo relativo al porcentaje de aprobados hay una gran diferencia entre los que pagan los certificados, con porcentajes de finalización alrededor del 50% los últimos años y en años anteriores llegaron al 75% (es muy probable que las iniciativas de edX ofreciendo certificados gratis hayan tenido una influencia en la bajada de este porcentaje en 2020 y 2021, pues los porcentajes se acercan a los reportados por Littenberg-Tobias et al., 2020 cuando no se pagan los certificados) y los porcentajes de aprobados entre los que se inscriben de forma gratuita, que en los primeros años se movían entre el 5 y el 6%, en línea con lo reportado en otros estudios, tanto para estudiantes que pagan el certificado (Chuang y Ho, 2016, Goli, Chintagunta y Sriram, 2022) como para los que no (Chuang y Ho, 2016, Ruipérez-Valiente et al., 2017, Khalil y Ebner, 2014). La medida tomada por edX a finales de 2018 para mejorar su sostenibilidad tuvo un impacto muy negativo en el porcentaje de estudiantes de no pago que aprueban los cursos.

En upvX, que no ofrece certificados, el porcentaje de aprobados se ha movido alrededor del 12,4%, cifra algo inferior al 15,4% de MiriadaX en 2013.

La medida tomada por edX a finales de 2018 sí tuvo un efecto significativo en la venta de certificados, suponiendo los confinamientos un nuevo tirón (distorsionado por las ofertas de certificados gratuitos de edX para instituciones de educación superior) y manteniéndose una tendencia positiva después de la pandemia (impulsada, posiblemente, por la bajada de precios de los certificados de los cursos en español que fomentó edX en 2020).

Las temáticas más demandadas, tanto para inscribirse, como para pagar los certificados, tienen que ver con el aprendizaje de idiomas y de habilidades específicas para el puesto de trabajo, como el Excel o la gestión de proyectos, lo que está en línea con las tendencias mencionadas en el último reporte de impacto de Coursera publicado (Yu et al., 2021).

Las más de 75.000 respuestas a la encuesta final indican que los participantes de la iniciativa de la UPV indican que los participantes están contentos con el sistema de aprendizaje basado en MOOCs (más del 93% valoran el sistema como excelente o bueno), creen que aprenden con los cursos (66% han aprendido bastante o mucho) y creen que los cursos han cubierto sus expectativas (con una media de casi 4 sobre 5, un valor algo inferior al reportado por Coursera de 4,7 (Yu et al., 2021). La razón alegada por los participantes para no haber terminado los cursos es, en más del 80% de los casos, la falta de tiempo.

Los participantes también reportan estar contentos con los cursos y con las plataformas utilizadas, con una satisfacción con la plataforma algo menor en la edición de

MiriadaX.

Con respecto a la pregunta sobre la opinión sobre la idoneidad de la duración de los vídeos de entre 3 y 10 minutos para aprender, a casi el 90% de los participantes le parece que la duración es adecuada, estando bastante equilibradas las respuestas que opinan que es corta (6,34%) o excesiva (4,37%), lo que indica que no hay un desbalanceo excesivo hacia una de las opciones.

La respuesta a la pregunta sobre la opinión sobre el soporte en foros, realizado por un grupo común de estudiantes asistentes en primer nivel, lo que descarga mucho a los docentes, puede ser muy interesante para los gestores de iniciativas similares, ya que 70% de los participantes consideran que el soporte fue adecuado y el 22% que fue suficiente pero lento, con solo el 7,8% que opinan que fue insuficiente.

También se aprecia que, aunque los diseñadores de los MOOC crean los cursos con cargas de 4 o 5 horas semanales como objetivo (la media publicada de dedicación los MOOC de la UPV está en 4,53 horas a la semana), cada estudiante le dedica unas 3 horas a la semana al seguimiento de los cursos, algo que debe ser tenido muy en cuenta a la hora de diseñar nuevos MOOC.

Los dos artículos sobre el uso de los MOOC realizado por la comunidad universitaria durante la pandemia también han contribuido a contestar al Objetivo 3.

En el artículo III se analizan las respuestas de 7.712 miembros de la comunidad universitaria de la UPV (el 23,4% de sus integrantes, incluyendo personal, alumnos e incluso antiguos alumnos) a un cuestionario sobre su participación en una iniciativa de reparto de códigos gratuitos de certificados MOOC de cursos de edX durante la pandemia que les permitió obtener más de 15.000 certificados con una tasa de finalización del 33% (del mismo orden de magnitud que el 47% reportado por Littenberg-Tobias et al.,2020 para los alumnos certificados de un MOOC de edX en el que se ofrecieron certificados gratis y muy superior a las tasas de certificación de alumnos que no pagan certificados que están entre el 4,5 y el 8% en diversos estudios consultados -KhalilyEbner,2014, Chuang y Ho, 2016 y Ruipérez-Valiente et al., 2017-).

Los miembros de la comunidad universitaria eligieron mayoritariamente cursos de la UPV (28%) y de algunas de las universidades e instituciones más prestigiosas del mundo (Harvard, MIT, IBM y Microsoft). Las temáticas más buscadas fueron Excel y lenguajes de programación para trabajar con datos, lo que coincide con los hallazgos del artículo general sobre los alumnos y con los cursos más populares del importe de impacto en 2021 de Coursera (Yu et al., 2021).

Un dato importante que reseñar es el gran desconocimiento que había sobre los MOOC entre los miembros de la comunidad universitaria, desconocimiento que cambió con la iniciativa. Hay varios artículos que reportan que este desconocimiento es incluso mayor entre el público en general (Radford et al., 2015, Muzafarova y Kaya, 2015, Shakya et al., 2016), con lo que las plataformas MOOC deberían redoblar sus esfuerzos en dar a conocer su oferta al gran público.

Una satisfacción promedio con la iniciativa de 4,7/5 y con la calidad de los cursos de 4,1/5 y un 73,6% de los comentarios abiertos catalogados como positivos hacen que se pueda concluir que la comunidad universitaria acabó satisfecha con la iniciativa (la satisfacción es similar al 4,7/5 reportado por Coursera, la mayor plataforma MOOC del mundo, en su informe de Impacto de 2021 (Yu et al., 2021)).

La comunidad UPV también respondió que los conocimientos adquiridos les serán útiles en su carrera profesional (3,67/5), en línea con el 71% de los usuarios de Coursera que informaron de beneficios en su carrera profesional (Yu et al., 2021). Una amplia mayoría

de los que respondieron la encuesta declararon que harán más MOOC en el futuro y que merece la pena pagar por los certificados.

Dado el éxito de la iniciativa, la UPV se ha adherido a la continuación de la misma lanzada por edX (con 135 cursos de 16 instituciones), programada para terminar en junio de 2022 y que ha sido prorrogada hasta junio de 2024 y ha lanzado su propia iniciativa con códigos para la comunidad universitaria que permiten obtener certificados gratuitos de sus MOOC y que han permitido sus miembros obtener más de 1.800 certificados.

Los resultados de la investigación en revisión resaltan la importancia de pensar en los MOOC no solo como un recurso puntual sino como una inversión estratégica que impacte su docencia y el desarrollo profesional de su comunidad (Castañeda, Esteve_Mon y Postigo_Fuentes, In press).

En el Artículo III se estudia el uso de los MOOC por la UPV durante la pandemia para cubrir las prácticas presenciales en empresa que no pudieron realizarse. El 90,4% de los 179 estudiantes que eligieron los MOOC para cubrir los créditos de sus prácticas en empresa aprobaron las prácticas y la satisfacción con la iniciativa MOOC de aquellos alumnos que respondieron el cuestionario final fue de 4,57/5.

Las conclusiones obtenidas de las notas conseguidas y la opinión de los estudiantes es que, en un entorno a distancia obligado los MOOC pueden ser una buena herramienta para proporcionar un porcentaje importante de los conocimientos que se obtienen en una práctica en empresa presencial, algo que podría lograrse incluso mejor en entornos donde se pueda planificar previamente y añadir actividades y recursos extra para complementar a los MOOC, de hecho creemos que se podrían utilizar los MOOC para reforzar las prácticas tradicionales introduciendo itinerarios previos de MOOC sobre habilidades básicas (Excel, trabajo en equipo, liderazgo, gestión de proyectos, programación) adaptados a la práctica que vaya a realizar el alumno.

Con ello podemos afirmar que se han conseguido los objetivos institucionales que se perseguían y que la tesis ha logrado su objetivo de estudiar la iniciativa MOOC desde los distintos puntos de vista de los actores más importantes.

Adicionalmente, la tesis ha tenido resultados adicionales no planificados inicialmente, como la aplicación de técnicas de aprendizaje automático para la realización de revisiones de literatura exhaustiva en colaboración con investigadores de otras instituciones, abriendo espacios de colaboración para proyectos futuros.

Toda la producción de artículos y presentaciones relacionados con la tesis puede consultarse en el siguiente enlace (https://bit.ly/ORT_IDespujol).

5.2. LIMITACIONES

Como ya se ha mencionado, en esta tesis se lleva a cabo el estudio de un caso específico, que, aunque de gran envergadura, no deja de ser un caso único. Como puede comprobarse en el Desarrollo de la tesis, la implementación de una iniciativa MOOC en una institución de educación superior conlleva un esfuerzo importante e implica muchas cosas importantes con gran cantidad de detalles que deben tenerse en cuenta

Como enuncian Liyanagunawardena, Adams y Williams (2013) y confirman Raffaghelli, Cucchiara, y Persico (2015) y Veletsianos y Shepherdson (2016), el análisis de una implementación MOOC debería tener en cuenta la necesidad de entender las multiples perspectivas sobre su funcionamiento de los distintos implicados y considerar aspectos a resolver como dar soporte a la autoregulación de los estudiantes, clarificar los problemas éticos de uso de los datos generados y estudiar las implicaciones pedagógicas de los MOOC.

Todo esto sin entrar en profundidad en el análisis de las implicaciones socio-éticas y políticas de estos cursos (Rolfe, 2015).

En esta tesis se han estudiado diversas perspectivas y puntos de vista de la implementación de una iniciativa MOOC, pero esto solo cubre parte de la implementación de los MOOC, que forman un complejo ecosistema con muchos aspectos diferentes.

Otra limitación es que los cuestionarios han sido enviados a todos los usuarios y respondidos por aquellos usuarios que lo han considerado oportuno, con lo que no tienen por qué seguir la distribución estadística de la población original. Aun así, la gran cantidad de respuestas recibidas hacen relevantes sus resultados.

El equipo es consciente de que se requiere un análisis pedagógico más profundo, aunque la propia naturaleza de estos cursos hace difícil hacer un análisis significativo desde el punto de vista didáctico (Bates, 2015).

5.3. PROPUESTAS DE FUTURO

El artículo V en la forma creemos que da buena cuenta de lo mucho que tenemos pendiente por investigar en relación con los MOOC en general. La necesidad de una investigación más influyente sobre los MOOC desde una perspectiva pedagógica, sobre los modelos pedagógicos y las teorías de instrucción y aprendizaje aplicadas a los MOOC. Asimismo, nuestros resultados apuntan a que existe una fuerte necesidad de avanzar en la investigación realizada dentro de los temas de participación y enfoque pedagógico e ir más allá de los aspectos que cuantifican la participación. Además, se aprecia la carencia de investigaciones que aborden temas sociales como la brecha digital, la privacidad de los datos, la ética, los aspectos interculturales o la internacionalización). Además, nuestra investigación apunta a la necesidad de acumular y agregar datos para consolidar el conocimiento sobre el e-learning utilizando técnicas de meta-análisis que apoyen la extracción de resultados y conclusiones más sólidas que informen la política y desarrollen la práctica basada en la evidencia.

A la vista de ello y del desarrollo de esta tesis, a continuación, reflejamos las **oportunidades y propuestas futuras** a seguir con esta línea de investigación:

A raíz de la realización de esta tesis se han llevado a cabo dos estudios en colaboración con otros investigadores que abren líneas interesantes de investigación para el futuro, uno sobre el uso de los MOOC de nivelación por parte de los alumnos de la UPV (Llorente, Despujol y Castañeda, 2021) y otro sobre el uso de aprendizaje automático para la predicción del abandono (Martinez y Despujol, 2021)

Los datos disponibles permiten realizar análisis parciales mucho más exhaustivos y profundizar en temas como la influencia de los cambios de política de edX en el porcentaje de aprobados y los certificados vendidos, las causas de las distintas tendencias temporales, el punto de vista de los participantes sobre cursos o temáticas concretas, o la clasificación de los participantes según su intención de acabar (siguiendo el modelo propuesto en Alario-Hoyos et al., 2014). Además, los más de 10.000 comentarios recibidos en el campo de respuesta libre pueden ser analizados de forma cualitativa para extraer conclusiones más profundas.

La creación de estrategias y procedimientos para evaluar la calidad del aprendizaje y mejorarlo es otra de las líneas que se trabajarán en el futuro para complementar las conclusiones obtenidas en esta tesis.

CAPÍTULO 6. REFERENCIAS BIBLIOGRÁFICAS

CONTENIDOS DEL CAPÍTULO

6.1. REFERENCIAS EMPLEADAS EN ESTE INFORME

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