

Ten years of MOOCs at the University of Liège (2015-2025): knowledge dissemination and pedagogical innovation.

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Abstract. Over the past few years, Massive Open Online Courses (MOOCs) have emerged as a major lever for transformation in higher education and continuing education. At the University of Liège, their development has been based on an ambitious strategy combining technological innovation and pedagogical integration. These online courses are no longer limited to simply providing free access to knowledge but are fully integrated into academic curricula and professional qualifications.

The adoption of hybrid formats has made it possible to enrich the student learning experience by combining MOOCs with a variety of teaching approaches, such as flipped classrooms and collaborative activities. Far from being content with traditional resources, these courses are based on interactive tools, augmented reality simulations and serious games, promoting more immersive and engaging learning.

The development of MOOCs also raises issues relating to the assessment and recognition of acquired learning. Certifications and micro-certifications are developing, offering new prospects for learners seeking official validation of their skills.

Artificial intelligence is emerging as a key factor for improvement. Thanks to it, adaptive learning, automated assessment and personalised support are becoming accessible realities. However, these advances require in-depth ethical reflection on data protection and content accessibility.

The rise of MOOCs is paving the way for a more flexible and inclusive education, where technology is used to support learning and student success.

Keywords: MOOC, innovation, hybridization

1 Introduction and history

Before the rise of MOOCs (Massive Open Online Courses), the University of Liège (ULiège) already had a solid experience in e-learning and multimedia production. Since the 2000s, it has been incorporating digital technology into its teaching by recording lectures and creating teaching videos on its distance learning platform.

This momentum accelerated in 2012 with the creation of a Multimedia Studio to professionalise the production of educational content. In 2015, at the instigation of the

Vice-Rector for Education, a pilot project was launched with the production of 3 MOOCs. A comparative analysis of the platforms and their content led to the choice of France Université Numérique (FUN MOOC)¹, aligned with the needs of ULiège and its French-speaking community. At the same time, a first “MOOCLab” workshop helped teachers to create their MOOCs using the PEPITE method [1-2]. Building on this initial success, ULiège quickly structured its project with co-funding from the European Social Fund (ESF).

Between 2016 and 2018, 12 MOOCs were created, involving 80 teachers and 250 experts. ULiège's approach is based on several principles: integration into academic curricula, a demand for quality, a collegiate approach, the development of a community of practice and the exploration of new technologies. In 2018, a partnership with an incubation platform dedicated to the creation of innovative training projects in collaboration with higher education, vocational training and the private sector² paved the way for SPOCs (Small Private Online Courses) aimed at businesses, while a unit specifically dedicated to MOOCs is being set up and strengthened by the recruitment of 3 technopedagogical experts with scientific backgrounds and the creation of a new production studio.

In 2019, the authorities will structure various services, including the production of MOOCs within the Digital Tools CARE (research and teaching support unit). The Covid-19 crisis further accelerated this dynamic, leading to an explosion in enrolments and confirming the central role of MOOCs in educational continuity [3]. ULiège is putting in place annual calls for projects and strengthening its international collaboration in the creation of MOOCs.

In 2021, the university will already have 21 MOOCs with 275,000 registered learners. Since then, the project has been part of an institutional strategic plan aimed at strengthening the appropriate use of digital tools to improve teaching.

With more than 30 MOOCs and 625,000 learners (January 2025 data), ULiège is the eighth largest producer of MOOCs on FUN MOOC. Under the new governance, calls for projects to support the creation of new resources incorporating pedagogical and technological innovations. Its distribution on FUN MOOC, thanks to a renewed strategic partnership, guarantees ULiège's MOOCs greater and lasting visibility.

2 Methodological framework

This article proposes a retrospective institutional case study over a period extending from 2015 to 2025, with the aim of documenting the production of MOOCs at ULiège in quantitative and qualitative terms, as well as the evolution of pedagogical practices for the creation and exploitation of MOOCs in the institution.

The data collected comes from various sources. Quantitative data, including the number of registrants, teachers or experts involved, are either extracted directly from the FUN platform during each open MOOC session and added together to obtain overall statistics on all the MOOCs produced, or extracted from reports drawn up internally at

¹ <https://www.fun-mooc.fr/fr/>

² <https://www.jobsatskills.be>

the end of each MOOC session. Qualitative data, as in the case of teaching scenarios or innovations, are examples documented from the notes and reports written by the techno-pedagogical advisor in charge of supporting the MOOCs or from the syllabi that the teachers must make available to the students at the start of each academic year.

The text is intended to be narrative, with a view to shedding light on the various aspects of the production of MOOCs at ULiège and does not claim to be an exhaustive survey of all the practices observed.

3 Video typology and motivational choices

Video clips play a central role in the design of MOOCs, constituting the main vehicle for transmitting knowledge. In 2015, we carried out an exploratory analysis of around 15 MOOCs and a retrospective examination of more than 1,000 multimedia productions made between 2013 and 2015. This analysis enabled us to identify 7 main categories of educational videos and to establish a typology of uses and mobilised resources [4].

Our experience and various studies on MOOCs have guided our choices in terms of video formats. We prefer short, engaging productions, with a discourse tailored to the target audience. Visual and thematic consistency ensures a homogeneous identity, while the diversity of formats makes learning more dynamic. In addition, we place great emphasis on storytelling to transform the learning journey into an immersive narrative, promoting engagement and reducing the fragmentation effect of short capsules.

Depending on the learning objectives, several types of video clips are used. The teaser, designed at the end of production, highlights the specific features of the MOOC and encourages people to sign up. The welcome message presents the objectives and speakers. The introductory videos contextualise the learning by means of summaries, micro-trotters or sketches. The content capsules, filmed in the studio or on location, use a variety of visual aids to facilitate memorisation. Illustrative videos go into greater depth on certain subjects, using experts or reports. Other clips accompany the exercises, providing feedback on the activities or suggesting avenues for further study. Finally, each module ends with a summary video, summarising the essential elements.

4 Learning levels for teaching activities

Unlike cMOOCs, which are inspired by educational trends such as connectivism and where learners play an active part in creating the content [5], ULiège has opted for the xMOOC model. This model is based on a more traditional teaching approach with online courses consisting mainly of video capsules followed by automated tests [6].

xMOOCs are often criticised for focusing on what Bloom (1956) calls «lower level» learning objectives, due to the standardisation of assessments (automated quizzes) and the lack of complex tasks (writing, collaborative projects) [7-8]. Margaryan, Bianco and Littlejohn (2015) come to a similar conclusion, highlighting that most MOOCs do not meet, or only partially meet, pedagogical quality criteria [9]. These online courses have significant limitations in terms of meeting university academic requirements, insofar as the development of «intermediate level» cognitive skills (application, analysis)

and «higher level» cognitive skills (creation, evaluation, synthesis) remains insufficient.

Aware of these issues, ULiège has sought to overcome these criticisms by drawing on the suggestions and recommendations of these authors and integrating into its MOOCs activities from the intermediate and higher levels of the 3 basic cognitive categories of Bloom's taxonomy (1956) [7]. Among the types of teaching activities proposed in our MOOCs, parliamentary simulation is a higher-level example. It invites students to play the role of a Member of Parliament from a fictitious republic and to interact using Web 2.0 tools such as Kialo, for structured argumentation, or Padlet, for collaborative work. There are also critical reflection activities, such as the analysis of recent scientific articles within the framework of precise instructions via discussion forums, to encourage more in-depth appropriation of the content and an increase in cognitive complexity. In addition, the ULiège MOOCs are promoted in the students' classroom courses, with which they are linked in various ways, as described later in this article.

This synergy enables students to acquire the theoretical foundations independently using the MOOC before going on to deepen and apply the intermediate and higher levels of Bloom's taxonomy in class.

5 Diversity of MOOCs and audiences on the FUN MOOC platform

The MOOCs produced at ULiège cover 3 sectors: the humanities and social sciences, health sciences, and science and technology. In each of the 3 sectors, there are MOOCs aimed at a diverse range of learners.

The first category includes so-called «general public» MOOCs which, as the name suggests, are aimed at a wide audience, including self-study learners, and do not require any pre-requisites. This category also includes «core» MOOCs, which are more specifically aimed at first-year students, to support remediation and the alignment of knowledge [10].

A second category is made up of specialised MOOCs aimed at advanced university students and professionals. These are courses that often form part of graduate courses and professional qualifications. They meet the growing need for continuing education and adaptation of skills to the labour market [11].

Finally, a third category includes mixed MOOCs, which offer differentiated courses, combining modules accessible to all with specialised content for advanced learners. This type of teaching scenario is part of a flexible approach, enabling learning to be customised according to the level and needs of participants [12].

6 Certification and recognition of acquired learning

From the outset, the ULiège MOOCs were conceived as tools integrated into the academic curriculum. However, the development of online training and the growing interest of a wider public (particularly professionals and continuing education students) have led us to reflect on the certification procedures. This dynamic is in line with trends observed internationally, where MOOCs are no longer limited to self-taught courses, but are becoming tools for training leading to qualifications [13].

In 2016, the FUN platform introduced 3 certification methods: face-to-face examination, validation by submission of a dossier, proctored online examination. These arrangements are designed to strengthen the academic credibility of MOOCs and encourage their institutional recognition. In 2020, ULiège experimented with a certification path for 6 MOOCs, enabling learners to obtain a certificate of achievement signed by the project leaders. However, these certifications, although rewarding, did not yet confer ECTS credits, which limited their full integration into university courses. With a view to academic and professional recognition of the skills acquired online, ULiège is now exploring the possibility of integrating MOOCs into University Certificates, in accordance with the framework defined for Belgium by the *Académie de Recherche et d'Enseignement Supérieur* (ARES - Academy for Research and Higher Education). Several of the University Certificates offered at ULiège already include a MOOC as the main component of the course. This is supplemented by online or face-to-face sessions, organised before or after the course, to go into the content in greater depth.

Building on these experiences of successful hybridisation, we are seeing a gradual but significant change in attitudes: MOOCs are now tending to be recognised as autonomous, creditable teaching entities. This is in line with European initiatives around micro-credentials³, which allow «small volumes of learning» to be validated and encourage the modularisation of educational pathways. Micro-credentials thus meet a growing demand for flexibility and recognition of learning outcomes. They are part of a drive to encourage a skills-based approach and to promote the mobility and employability of learners by means of certifying training units.

7 Linking MOOCs to ULiège curricula

One of the special features of ULiège's MOOCs is that they need to be hybridised with the institution's student curricula in order to meet specific teaching needs, while maintaining a certain academic rigour. The ways in which MOOCs are integrated into ULiège courses are therefore an essential component of their development and implementation.

This linkage has already taken a number of well-described forms, including a «pendulum» type of hybridisation which is similar to the flipped classroom system and favours the rhythm of the course, by reversing the moments of passive transmission of knowledge and those of active work [14-15]. This model is also supported by the work

³ <https://education.ec.europa.eu/fr/education-levels/higher-education/micro-credentials>

of Hattie (2009), who highlights the effectiveness of teaching strategies that encourage student interaction and engagement [16].

The “sandwich” articulation places the MOOC at the centre of the course and stimulates learner autonomy, an aspect which refers back to the idea of autonomous learning put forward by Knowles (1975) in his theory of andragogy, as well as to the theory of situated learning by Lave and Wenger (1991) [17-18], who stress the importance of making the learner the actor of his learning.

On the other hand, “tetris” hybridisation brings transversality in the use of resources between different courses, which echoes the idea of networked learning, where knowledge is connected across different disciplines and learning formats [5,14].

In addition to these 3 models, 3 others are currently being studied. There is the “base” model, where a MOOC is a pre-requisite resource for a face-to-face course: online resources prepare students for more advanced learning experiences. The «bonus» model, where MOOCs are additional resources and enrich the learning experience by offering content that complements the basic programme. The «skeleton» model, on the other hand, tends to replace 100% of the face-to-face course and is part of the totally distance learning framework, where MOOCs can take over from traditional face-to-face teaching, but require adapted approaches to maintain student engagement and interaction.

8 PEPITE: a structured protocol to support teachers in producing MOOCs

At ULiège, support for teachers in designing their MOOCs is based on a dedicated protocol, PEPITE [1-2], which is an adaptation of the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) [19]. This model is based on a systematic approach to pedagogical engineering, encouraging iterative design and continuous improvement of digital resources [20]. The PEPITE protocol is structured in 6 key stages.

Preparation is the first phase, consisting of an analysis of pedagogical needs and a study of what already exists to avoid duplication with other MOOCs. It is essential for defining target audiences and learning objectives, in line with the principles of pedagogical alignment [21]. This stage is also in line with the work of Merrill (2002), who stresses the need for consistency between content, objectives and assessments right from the planning stage [22].

The development of the scripts for the video clips and teaching resources is a central point in the design of the MOOC. This writing stage is in line with the principles of Mayer's cognitive theory of multimedia learning (2001), which recommends the use of short, engaging multimedia content to maximise knowledge retention [23].

The Production phase involves filming and editing the video clips. It relies on collaboration between teachers, graphic designers and technicians to guarantee high-quality productions. The use of collaborative online video editing tools facilitates asynchronous work, an approach that is in line with the principles of participatory design of educational resources [11].

Once finalised, the MOOC is integrated into the FUN platform during the Implementation phase and is officially launched with a communication strategy. This stage

is in line with research into the dissemination of educational innovations, which emphasises the importance of institutional ownership to maximise the impact of MOOCs [24].

From the moment it is opened to the public at the start of the Transmission phase, the MOOC is actively monitored by teachers and support teams. Forum management plays a crucial role in creating a learning community, a key element according to the theory of cognitive, social and pedagogical presence [25].

Finally, the Evaluation phase, based on the analysis of data from registrations, completion rates and learner feedback, enables future sessions to be adjusted and improved.

Teacher support via PEPITE initially took 2 forms: individualised monitoring, with regular meetings between teachers and techno-pedagogical advisors, and collective support, through training courses called MOOCLabs, which fostered a community of practice dynamic [2]. This methodology has had positive effects on several levels, including improving the pedagogical quality of MOOCs, the professional development of teachers, pedagogical innovation and academic influence through scientific publications and communications [2,26-29]. With the increase in the number of MOOCs produced and the diversification of production rates, ULiège has gradually adapted its support practices. Two major trends have emerged: more individualised support, giving teachers greater flexibility in their creation process, and centralisation of teaching resources, via an evolving database that was enhanced during the Covid-19 pandemic and is continually updated.

9 Educational innovation

The creation of MOOCs at ULiège is based on a strong desire for educational innovation. This approach can be seen, for example, in the exemplification of laws of physics through sporting activities, as in the MOOC *La physique générale pour bien entamer l'enseignement supérieur*, where sport facilitates the understanding of scientific concepts. Similarly, the MOOC *Agir pour sa santé* includes a logbook enabling students to adopt new health behaviours, in line with modern approaches to active education [30].

Innovation is also based on the use of virtual reality (VR) and interactive simulations. The MOOC *Introduction to Histology* uses a virtual microscope to explore histological sections in a free or guided way, while the MOOC *Tout comprendre sur le climat et son réchauffement* integrates a 3D VR application to visualise atmospheric phenomena. The MOOC *Les hiéroglyphes égyptiens* features the HieroglyphsVR application, allowing 360° immersion in the tomb of Amenemope. VR enhances learning by providing a sensory and immersive experience that promotes engagement and information retention [31-33].

Collaborative learning is also central. For example, the parliamentary simulation in the MOOC *La Fabrique de l'aide internationale*, where learners reform development aid policy in a fictitious country (Hopeland), illustrates the contribution of social interaction in digital environments. Anderson (2008) shows that these practices enhance understanding and motivation [34].

The use of collaborative tools such as Padlet, Wooclap and Kialo encourages the exchange and co-construction of knowledge [35]. This hybrid approach, combining online and face-to-face learning, stimulates creativity and critical thinking [36].

The serious game Effugereludus, based on the principles of escape, extends this experience in the 2D environment of GatherTown⁴ by allowing learners to explore the themes of development aid through interactive enigmas [37].

Analysis of feedback from some learners reveals concerns about the technical complexity of the platform and the durability of access to content. To remedy this, digital textbooks incorporating QR codes for accessing videos ensure better accessibility and continuity of learning [34].

In addition, the rise of webinars is enhancing interaction between students and teachers. The experiments carried out at ULiège with the Campus Media de la Grand Poste⁵, in partnership with the journalism department, illustrate how MOOCs can evolve by integrating immersive multimedia content, thereby strengthening learner commitment [38].

10 Accompanying stakeholders

Our techno-pedagogical and production teams rely on recommendations including those of Richard Mayer (2001) and John Sweller (1988) about cognitive load [23,39].

Upstream preparation is a determining factor. Each capsule is the subject of a script drawn up jointly by the teacher and the techno-pedagogical team, guaranteeing a coherent and fluid structure. Attention is paid to the balance between the visual and auditory channels to avoid cognitive overload, by highlighting the essential information and favouring capsules of an optimal length of around 7 minutes. The aim is to maximise learner engagement by offering clear, concise and structured content.

The use of 2 cameras, positioned in such a way as to alternate between a wide shot and a close-up of the speaker, leads to more dynamic editing, while the use of a prompter not only saves time by limiting hesitations, but also ensures direct visual contact with the learner.

Coaching, inspired by theatre and public speaking techniques, is offered before the recording to help teachers work on their posture, body language and intonation. These exercises are designed to make their speech more natural and engaging.

Finally, the adoption of a collaborative audiovisual platform⁶, which facilitates asynchronous exchanges between speakers and our team during the editing phase, has proved particularly effective in facilitating the process of validating the clips and guaranteeing a consistent level of quality.

⁴ <https://www.gather.town>

⁵ https://www.infocom.uliege.be/cms/c_4570518/fr/infocom-grand-poste-media-campus

⁶ <https://frame.io>

11 Outreach and external partners

The experience accumulated by our team in creating MOOCs has enabled us to develop a wide range of support and partnerships, going beyond the traditionally massive framework of MOOCs. These partnerships, whether internal to ULiège or external, have enabled the exchange of teaching practices and led to the co-creation of digital content in advanced fields such as robotics, digital twins and satellite data analysis. This content was offered in bulk mode on the FUN MOOC platform, as part of an awareness-raising approach, before being adjusted to meet more specific needs identified through feedback from participants. These sessions have enabled us to better understand the expectations of the public, so that we can offer more targeted training.

For some MOOCs, we have explored the creation of content to meet specific demands from companies wishing to train their staff. We have also developed partnerships with universities looking for specific content to complement courses where expertise was lacking. This type of collaboration underlines the importance of MOOCs in enriching traditional educational programmes, a phenomenon described by Laurillard (2013), who highlights the ability of MOOCs to complement the teaching resources available in a variety of academic contexts [11].

Finally, we recently had the opportunity to collaborate with European universities as part of the UNIC project⁷, an alliance of 10 universities located in post-industrial urban ecosystems in transition. The aim of this project is to develop mobility, inclusion and teaching and learning models adapted to a context of superdiversity. As part of this, we had the opportunity to train our European colleagues in our teaching practices. This transfer of know-how took place in a hybrid format, during face-to-face exchange days in our studios, remotely via the GatherTown platform or through an online learning path. The use of GatherTown in this context illustrates the rise of collaborative virtual environments, supported by studies into their effectiveness in engaging and cohesive groups of learners [40].

12 The future of MOOCs in the age of artificial intelligence

The development of artificial intelligence technologies is opening new prospects for the production and enhancement of MOOCs. However, it is vital to remember that the teacher remains a central player in distance learning. Just as we have chosen not to replace teachers with actors in our videos, we must ensure that AI does not alter this essential link with learners.

AI could prove to be a valuable ally on several levels. It could make it easier to summarise and adapt content, making it more accessible to different audiences. For example, its use in writing scripts would enable the level of language to be automatically adjusted according to the needs of the learners, thereby promoting greater accessibility. AI could also play a key role in automating certain tasks, such as generating and synchronising subtitles, thereby reducing the time spent on post-production. In the

⁷ <https://unic.eu/en/about>

longer term, the development of dubbing and text-to-speech technologies could improve the multilingual accessibility of MOOCs. Finally, AI could also help to optimise workflows by automating certain repetitive tasks, allowing teams to concentrate on the more strategic and creative aspects of production. The use of AI could enable more individualised monitoring of learners, with the creation of personalised pathways or personalised feedback. However, this type of use also raises the issue of personal data processing. The analysis of interactions and learning behaviour must be carried out within a framework that complies with the GDPR and the principles of transparency. Although these technologies are not yet fully integrated into our workflow, they represent a promising lever for innovation, likely to improve the efficiency and quality of the MOOCs produced at the University of Liège.

That said, this migration must be consistent with the pedagogical principles that guide our approach to creating the content that makes up our MOOCs. The future of artificial intelligence in support of MOOCs lies in its ability to work in synergy with human intelligence to offer more effective, accessible and inclusive course content.

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