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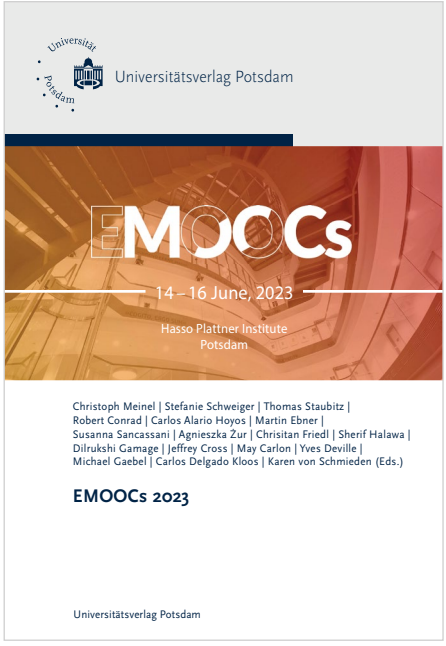

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From MOOC to "2M-POC"

An approach to Transform a Traditional MOOC to an Efficient Multi-Modal Learning Path for Companies

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IFP School develops and produces MOOCs since 2014. After the COVID-19 crisis, the demand of our industrial and international partners to offer continuous training to their employees increased drastically in an energy transition and sustainable mobility environment that finds itself in constant and rapid evolution. Therefore, it is time for a new format of digital learning tools to efficiently and rapidly train an important number of employees. To address this new demand, in a more and more digital learning environment, we have completely changed our initial MOOC model to propose an innovative SPOC business model mixing synchronous and asynchronous modules. This paper describes the work that has been done to transform our MOOCs to a hybrid SPOC model. We changed the format itself from a standard MOOC model of several weeks to small modules of one week average more adapted to our client's demand. We precisely engineered the exchanges between learners and the social aspect all along the SPOC duration. We propose a multimodal approach with a combination of asynchronous activities like online module, exercises, and synchronous activities like webinars with experts, and after-work sessions. Additionally, this new format increases the number of uses of the MOOC resources by our professors in our own master programs.

With all these actions, we were able to reach a completion rate between 80 and 96 % – total enrolled –, compared to the completion rate of 15 to 28 % – total enrolled – as to be recorded in our original MOOC format. This is to be observed for small groups (50–100 learners) as SPOC but also for large groups (more than 2500 learners), as a Massive and Multimodal Private Online Course ("2M-POC"). Today a MOOC is not a simple assembly of videos, text, discussions forums and validation exercises but a complete multimodal learning path including social learning, personal follow-up, synchronous and asynchronous modules. We conclude that the original MOOC format is not at all suitable to propose efficient training to companies, and we must re-engineer the learning path to have a SPOC hybrid and multimodal training compatible with a cost-effective business model.

1 Introduction

IFP School is an engineering school that offers applied graduate programs, providing students and young professionals with education in the field of energy and mobility. Our main concern is to meet the needs of the industry in terms of skills with a particular emphasis on providing applied knowledge on sustainability and innovation.

MOOCs and online courses have been around for some years now. As many institutions, IFP School entered the world of online courses initially to address three main goals: to increase institutional visibility, to keep the leadership in education and new learning techniques and to provide training for our staff in these new digital learning tools.

With these three goals in mind, the very first-generation MOOCs of IFP School were produced and proposed to an open public. "Sustainable Mobility" was released in 2014 while MOOC "Oil&Gas" was released in 2015. Both consisted of a series of videos and evaluations to assess learners' knowledge. Some parameters and features were chosen to guarantee learners' motivation and completion. For instance, it has been proven that learning through games and playing is one efficient way to improve the learning experience. In consequence, most of the evaluations proposed were chosen and designed as mini games or serious games. Another example was to include storytelling techniques with characters that invited learners to move forward in the activities. Even the choice of short videos (between five and ten minutes) helped guarantee that learners would stay focused until the end.

All these engagement tools and their effects have been explained in former eMOOC conference papers [6, 5, 7, 4].

Some figures regarding the first editions of these MOOCs are presented in Table 1. The completion rate is presented in two ways: (1) the number of certified participants against the total number of enrolled participants and (2) the number of certified participants against the number of active participants (participants that have started at least one video or activity). Both courses were open to anyone completely free.

Table 1: First generation of IFP School MOOCs data

	Total enrolled	Completion rate (total enrolled)	Completion rate (active participants only)
"Sustainable Mobility"	3099	31 %	59 %
"Oil&Gas"	21840	28 %	67 %

The completion rates obtained by both MOOCs were impressively high compared to the average completion rate data available at the time. Even more, each MOOC was run three times in a one-year interval with equivalent results in terms of number of participants and completion rate. The experience was a success beyond expectations. Even though the business idea was not included in the original design of these MOOCs, the school perceived an indirect return of investment that was impossible to quantify in terms of income but enough to continue with the experience.

Two new, second-generation MOOCs were produced with similar goals: "Tomorrow's Mobility" in 2018 and "Energy Transition" in 2019. At the time, our main concern was to improve our visibility in new fields (cleaner energies and cleaner forms of mobility) matching the evolution of the content of our programs and the needs of society in terms of skills. Some pedagogical innovations were included like serious escape games or the addition of a sketch notes conclusion to highlight the main ideas at the end of the videos. The course difficulty was also increased for "Tomorrow's Mobility" and decreased for "Energy Transition", compared to the first two MOOCs. The table below shows the results for the first editions of the second-generation of IFP School MOOCs.

Table 2: IFP School second generation data

	Total enrolled	Completion rate (total enrolled)	Completion rate (active participants only)
"Tomorrow's Mobility"	4981	20 %	57 %
"Energy Transition"	25834	19 %	68 %

As before, each of the MOOCs was proposed to an open public during three editions, with the latest editions overlapping with the COVID-19 pandemic situation. The graph (Figure 1) below shows the comparative results for the three editions of the second-generation MOOCs: even though the completion rates were still very promising, it was clear that the MOOC format was slowly losing the massive public it initially captivated.

The figures regarding the MOOC participants also show that the targeted audience (students) was very often outnumbered by professionals. Taking a closer look at the profile of participants, we could see many employees from industrial companies taking our MOOCs (up to 1000 employees from the same company: this number is certainly underestimated since we could only track those participants using their professional email address). For example, MOOC "Energy transition's"

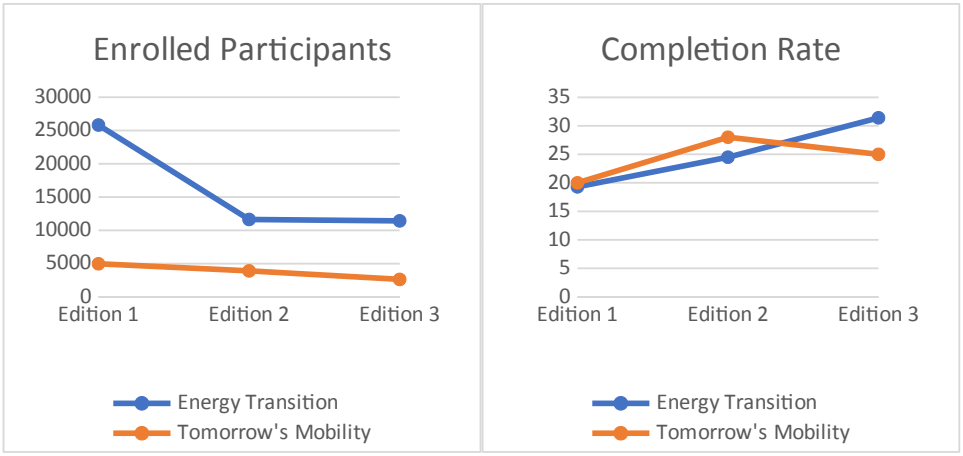

Figure 1: Comparison of three editions, second generation of IFP School MOOCs

third edition saw 64 % of professionals registered compared to 26 % of students (the first edition had 31 % of students while the second one had 35 %).

At the same time, some industrial partners asked the school to run some of the MOOCs as Small Private Online Course or so-called SPOC. The business idea started to grow as a result of several aspects combined:

1. The needs of the industry to educate their employees with new skills using digital techniques that provide reduced cost. It was seen that MOOC formats were not completely adapted because the massive character implied general contents not matching specific needs for a company.

2. The education needs are changing at a pace that makes it difficult for traditional schools to adapt even if there is a strong will to keep up the pace. It goes beyond the digital world where it is common to see a fast rate change of technology. The skills needed by industrials in the energy and mobility sectors are also quickly changing and it demands continuous learning from the employees. As an example of this idea, students that received a Powertrain Engineering degree from IFP School in 2019 were working in 2021 on an already new subject of hydrogen mobility that was not addressed during their studies.

3. Investments in terms of time and money were extremely important. The MOOCs were included in the curriculum of some of the IFP School master programs, but the use in the master programs was not enough to justify such an investment. The massive character of online courses is what makes it economically

sustainable, as well as the original fundings. The school could not continue to support the MOOC activity without including the development of a business model including industrial partners.

4. Finally, the COVID-19 situation impacted the interest of learners for traditional MOOCs. Many reasons can explain the situation. As a result, the interest in the courses dropped progressively with less participants following the MOOCs (see Figure 1).

The exponential growth in the numbers of MOOCs – oriented for students, as a soft marketing tool – is finished. It is time for a new format of digital learning tools. The COVID-19 pandemic has probably accelerated the phenomena. The aim of this article is to show how to adapt to the new reality education is facing, with a particular focus on continuous training for professionals. It explains the choices that have been made to produce learning devices that are meaningful, efficient and with controlled costs.

2 MOOCs AS Digital learning tools for industry

2.1 The companies' need

As explained in the previous section, we are facing times where continuous learning has become mandatory to keep track of the skills companies are looking for. Not only soft skills, but also hard skills. On the side of employees, the skills learnt during university might be soon outdated, as shown in the example of the Powertrain Engineering batch of 2019. The abilities to adapt, to learn and to change have become mandatory for professionals.

Companies play an important role in ensuring training and providing the skills for their employees' overtime. The ecological transition is an example of corporate culture transformation that requires continuous training. In a context where employees are more and more accountable for their training and employability [3], and where companies face radical and rapid transformations not only in terms of technical skills but also in terms of corporate culture, digital trainings like MOOCs seem to be a promising solution.

From the Human Resources department's point of view, MOOCs represent "a new opportunity for managers to rapidly reconfigure organizational resources at low cost in a competitive context that emphasizes the ability of any organization to adapt to change" [3].

3 The use of MOOC as free training content

Some external platforms started to inventory MOOC content[1] in 2013/2016, accompanying the trend of MOOCs and the need of individuals and companies to find content on specific subjects opening. It led the way to the use of COOC – Corporate Online courses [1]. However, experience shows that giving employees access to these training "buffets" does not necessarily give them the "willingness" needed to complete those courses [3]. This is especially true if there is a lack of motivation from the management, social interaction, and/or follow-up (most of the literature found about MOOC for corporate training are based on this use of MOOC to do so).

4 The use of MOOC to provide specific internal training

IFP School sees an opportunity to address the challenges faced by industrials to provide training to their employees in a massive and economically sustained manner. The goals of this new learning tool shifted basically because we are addressing the client's needs first instead of our three main goals described in the previous section. Our goal in this case is to adapt the lessons learnt from the MOOC experiences so we can provide the best learning experience for companies while improving or updating the content of our courses. When specific development is made on client's request, an agreement is made regarding the intellectual property of the content co-developed. If the content is confidential, IFP School has no right to use it outside the framework of the collaboration. An example of this case is the production of specific videos with experts from the client's staff. When non-confidential aspects are requested, the modifications are the property of the school, so it is possible to re-use it for: IFP School students, new clients, or as MOOC. An example of non-confidential modifications is the development of the course in a new language: once the videos are subtitled in a new language, IFP School is free to offer the course in all the available languages to another client. In both cases, the client pays for the new development.

To give more concrete information, two examples based on the "Energy Transition" MOOC content will be presented below. Both examples are based on a request to provide the MOOC "Energy Transition's" courses to industrial compa-

[1] My Mooc (http://www.my-mooc.com) was created in France in 2016, which pivoted to corporate training in 2018 an Fun MOOC was created in 2013 (http://www.fun-mooc.fr)

nies' employees. Both started with the query to give access to the MOOC content outside the free, public periods of operation.

The first questions asked were the ones of a user centric approach:

- Who is the targeted audience? (Quality and quantity)
- What are the learning objectives?
- Does the content of the MOOC answer these objectives?

4.1 Example 1 – From a first generation of MOOC to a SPOC

In 2020, a first industrial partner eager to take advantage of the COVID-19 crisis to train their employees contacted us showing interest in the public courses we had already published online. Since our policy was to have some periods of the year open to the public for free, companies thought it would be possible to give them access to the resources for free. Instead, we proposed to them a formula that combined engineering expertise, pedagogy expertise and the know-how on online training. It was for us the first time to fully grasp the added value of this combination, enough to make a business model out of it.

In addition to the original content, we added some of the client's resources to personalize the course and provide a meaningful experience:

- an introductory video with one of the top managers of the company was specifically made for this course.
- Live sessions were held on specific dates to give pace to the learning experience and answer participants' questions. Sessions were either Q&As given by experts on the MOOC-topics, or tutoring sessions to engage learners to finish the training and make the best out of it.

In addition to these lives, we also provided the client with an emailing guide for an adapted communication to the learners, a close follow up of the 75 learners who participated in the SPOC.

For this client, an innovative multi-modal approach was developed. Multimodal means in this case that some parts of the training are to be done at the participant's pace, or asynchronous, and some parts are done at the same time by all participants, or synchronous. Some examples of synchronous sequences are a live introduction session to give the context of the training, a follow-up session to share practices and give tips to complete the MOOC, and webinars with experts to answer questions on important subjects. Some examples of asynchronous sequences are online forums, documents and videos. The experience was framed by a specific communication campaign co-constructed with the company.

This first experience was a success beyond our expectations with 80 % completion rate. For us, two main factors directly contributed to this result: first, the high-quality training design (scientific content combined with the social learning approach), and second, the involvement on the client's side to motivate and follow the process, with the learning hub and the manager of the business unit working in close relationship with us.

4.2 Example 2 – From a MOOC to a "2M-POC" third generation of MOOC

This second example comes from another industrial partner. The request was taking place in an overall cultural shift of a major energy firm. The MOOC "Energy transition" was to be part of the training of all the employees (more than 7500) to reinforce the change of mindset of the company. There were two parts in the requests:

1. The content of the MOOC "Energy Transition" was to be provided in three sessions with 2500 learners on each session.

2. Specific content was to be produced for top management on key topics based on the strategic expertise of our research community at IFP Energies nouvelles.

The result so far is a great success: 5000 employees enrolled in total throughout two out of three sessions, 95 % and 96 % completion rate (against total enrolled participants), more than 53 % of active learners asking questions to experts or taking part in the discussions forums. This success is the result of a team effort between the learning community manager, and the client's training service who truly worked hand in hand to motivate participants to finish.

Leaving aside the second part of the demand that concerns the production of specific content for the client, the first part was quite a unique experience. In addition to the content, experts would answer questions on forums, resulting in more than 1500 messages (questions and discussions). This type of online training cannot be called a MOOC. By definition, a MOOC is open to everyone, which was not the case here. It cannot be called a SPOC either since having 5000 learners enrolled (7500 total with the 3rd session) places the experience outside of the boundaries of a Small Private Online Course. We decided to call this new format "2M-POC": Massive Multimodal Private Online Course.

Other clients followed these initial two experiences. It confirmed the possibility to use online content as a marketable service adding value to companies that need training for their employees that is easily available at an affordable price.

5 What is a "2M-POC" third generation of MOOC?

After 2020, a strategic study was performed to assess our partner's needs and to look for business opportunities. The influence of the business opportunities seen before led us in a new direction. The third generation of MOOC – internally called "2M-POC" – was designed as a short, multimodal, cost-efficient format.

5.1 A shorter format

Designing a full-length MOOC is very costly both financially and in terms of human resources, if you want to create the content internally. In a survey on the use of digital training in universities, one interviewee tells Bruillard [2]: "The rate of reuse of a digital resource was inversely proportional to its size. The smaller the resource, the easier it was for teachers to include it in their course". Smaller "chunks" are easier, faster, and less expensive to make, ergo to update. This is important given the rapidity of changes in some of the topics. If a good number of "chunks" is produced, adapted training journeys can be designed by a personalized choice.

In a school, this approach has the advantage of blending better and easier in teachers' courses; and for industries, the advantage is to better address their needs. A topic can be addressed in a short, efficient way that is easy to introduce in a multimodal training path.

The "2M-POC" approach is a shorter version of the first-generation MOOCs where total duration was reduced from one month to multiple short standalone modules.

An example can be found in the course "Hydrogen for Mobility"[2]. The content was produced to address the need of the Powertrain master program to provide engineer level knowledge on hydrogen developments. The course is short and designed to be done in three to six hours. The advantage is that it easily fits into the program's schedules. On the industrial side, this short format meets the training requirements of our partners.

5.2 A sustainable business model

The original business model of MOOCs was not proven to be cost-efficient. *Udacity* was one of the first MOOC platforms to turn towards corporate training[3]. After

[2] https://academy.ifp-school.com/enrol/synopsis/index.php?id=201

[3] Schuman, R., 2013, The King of MOOCs Abdicates the Throne. Sebastian Thrun and Udacity's "pivot" toward corporate training. *Slate*.

2015 *EdX* and *Coursera* started to charge fees, other institutions tried to provide the course content for free and would offer the possibility to pay a fee to get an official certificate.

The first IFP School MOOCs – "Oil & Gas" & "Energy transition" – were made possible by the funding of industrial partners of the school. Fundings usually covered a part of the external costs regarding the development of the content, language adaptation or the platform costs. However, the cost of the internal human resources needed to develop the MOOC was supported internally and it was the biggest part of the budget. In some way, the income provided by these fundings to produce our first MOOCs was the beginning of the business model. For our sponsors, each campaign gave them the opportunity to train their employees, or future potential employees on a large scale.

Remember, at the beginning of the experience, IFP School MOOCs were used as a soft marketing technique: the search of a new image was the real target at the time. The idea was to reach qualified students all over the world, to promote the school and eventually get them enrolled in our master programs. Every student enrolled in the school is a source of income due to the tuition fees. Even if the MOOCs were entirely free (certificate included), an indirect income was received whenever a student came to the school because of our MOOCs. This was the hidden mechanism behind the strategy of the first MOOCs: 10 % of our students at the time got to know the school due to one of those MOOCs.

Third generation MOOCs ("2M-POC"), or "MOOC Chunks" are now designed on a specific demand: either coming from the internal IFP School side or coming from industrial partners. The course "Hydrogen for Mobility" initially developed for our master programs has found interested clients in our industrial partners since it is addressing a challenging topic.

These "chunks" can eventually serve as chapters of a full training path (e.g. "Hydrogen for mobility" to be included in a Hydrogen path).

A virtuous ecosystem

IFP School is part of IFP Energies nouvelles (IFPEN) – an industrial group that includes a research center, but also companies in the field of energy, mobility, and training dedicated to professionals.

In the first and second generation of MOOCs, most of the experts were teachers from IFP School, with few speakers coming from the research center. The MOOCs were designed for school communication with no real business strategy. In the third generation "2M-POC", sales objectives were considered at the beginning of each project. The MOOCs are now produced internally, by a dedicated structure called LAB e·nov™ – the digital culture laboratory of IFPEN, hosted by IFP School. For instance, video production is now also internal, with a multimedia studio facility located at LAB e·nov™.

IFPEN experts are often participants to create the videos, so the content is created in a "virtuous ecosystem". The idea is that the need to develop the content might come from any stakeholder in the ecosystem (IFP School, industrial partners, or clients, or even IFP Energies nouvelles research center). Research experts provide their knowledge through these "chunks" and they benefit from the pedagogical enhancement of the content by IFP School staff. IFP School receives high quality content that can be used for our students or for our industrial clients. The students usually serve as first users to test the modules. Asking our experts to produce the content is truly well received by their community because it gives them a showcase to their expertise.

5.3 A multimodal approach

In this third generation, we capitalized on MOOC deployment to keep the best practices for the asynchronous part. We stop considering a MOOC as a succession of videos and evaluations but kept them as central to constructing learning devices. The new "2M-POC" is designed to propose a real multimodal approach, mixing teaching modules and social aspects in a global training path (Figure 2).

Teaching modules
The modules are still mainly made from videos and documents to produce the training device. This asynchronous part is the center of the training. Additionally, in the "2M-POC" approach we propose other types of resources to obtain at the end of a relevant learning path. For example:

- flipped classroom,
- Q&A session to discuss with experts,
- specific lecture or a webinar at the end of a module to elaborate further on a specific topic,
- dedicated project or workshop where the students directly apply what has been taught.

For example, "Hydrogen for Mobility" is used by several masters at IFP School and is a mixture of six-hour flipped class resources, two additional live Q&A sessions, and a one-day application workshop using simulation tools. In parallel, it was deployed as a seasonal free MOOC training during students' application period and this campaign led to new industrial prospects.

Social approach
To complete the learning path and obtain a significative completion rate at the end of the module, the social aspects of the third generation MOOCs are also considered; for example:

- opening live session to give an overview of the training path (for SPOC and "2M-POC"),
- dedicated and personalized follow-up with participants to help some of them finish the content (all types),
- live afterwork session for our students or online afterwork session for the professionals using a specific online software (metaverse) to make the training more social,
- online Q&A sessions before the webinar that improve interactions between learners and experts (SPOC),
- regular "motivational" sessions to share some tips to "learn online" efficiently (SPOC),
- dedicated communication kit to support and motivate the teachers/students, company/learners all along the deployment period (SPOC and "2M-POC").

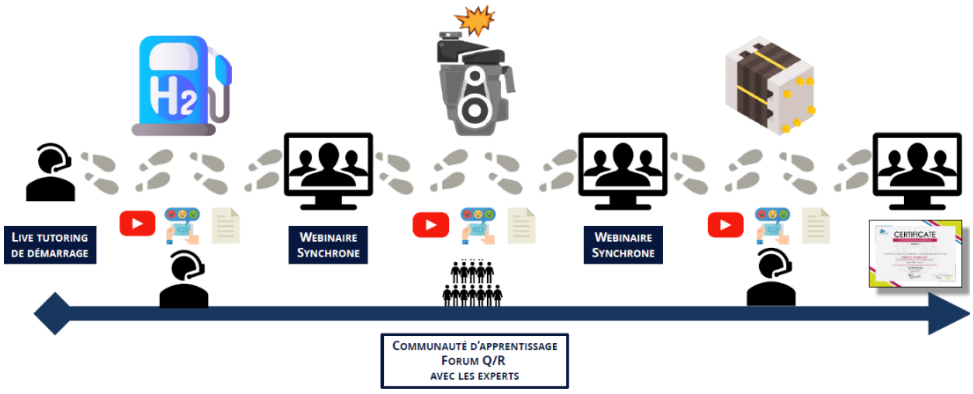

Figure 2: Training path example of a multimodal third MOOC generation

6 Conclusion

Since the beginning of MOOC production, it was difficult to propose a model that answers simultaneously the need of students, in school and universities, and the need of company's employees in a sustainable economical way. The COVID-19 crisis has clearly accelerated the demand of digital training from the industry sector. IFP School has taken this opportunity to propose a third generation of MOOCs with a new format called "2M-POC". This third generation of online training is based on a multimodal approach with a short, cost-efficient format, produced only on demand from at least one of the stakeholders of our "virtuous circle".

The results of the six "2M-POC" modules realized for three of our industrial partners are really encouraging with the following conclusions:

- a real interest for this approach from different companies all over the world,
- several tests have been done, with similar results, on different cohorts of learners from 100 (SPOC type) to 2500 (MOOC type) employees,
- a completion rate from 80 % to 96 % – total enrolled –,
- a high level of participation in webinars proposed all along the MOOC,
- a complete integration in the IFPEN ecosystem.

Finally, this third generation of "2M-POC" offers, for the first time, a real sustainable business model which allows us to continue to develop future training experiences for IFP School students and industrial partners; considering the global economic balance of the project.

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