Adoption of MOOCs by Emerging Countries Seeking Solutions to University Overcrowding

Literature Review and Feedback from the First Scientific MOOC Held by Sidi Mohammed Ben Abdullah University – Fez, Morocco

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Abstract—The adoption of various forms of distance education, particularly MOOCs (an acronym for Massive Open Online Courses), by universities worldwide has continuously gained momentum over the past decade. This is due not only to the importance of maintaining a parallel educational model alongside face-to-face courses in order to complete students' training, but also in response to the limits of academic infrastructure faced with an increasingly large mass of learners, typically in emerging countries. Universities view MOOCs as a remedy to this dilemma—one which promises reasonable development costs—especially taking into account the ubiquity of the internet and digital communication tools. In a country such as Morocco, whose university capacity has been stretched to 186%, the quest to dematerialize lectures can support universities in producing well-rounded professional profiles as well as improving institutional and academic services overall. In this paper, we present the feedback from Sidi Mohammed Ben Abdullah University concerning its first scientific MOOC, launched within the framework of the Maroc University Numérique (Morocco Digital University) or MUN project in collaboration with the France University Numérique (France Digital University) or FUN platform. The objectives of this paper are threefold: to assess the possibility of adopting further MOOCs in a Moroccan setting, to seek insight on the profiles of learners who have completed MOOCs and to draw lessons in order to improve future experiences.

Keywords—MOOC, Moroccan Higher Education, University overcrowding, Emerging countries

1 Introduction

From correspondence courses through the postal service to a wide variety of tools and content available on the Internet, distance education has evolved significantly. At

present, it consistently attracts the attention of universities as a method which acts in a complementary role alongside traditional face-to-face courses. This mode of education, which is improving from year to year as it aligns with technological developments, has established its presence as an essential tool for improving the educational performance of university professors and other instructors [1].

Recent years have marked the history of distance education with the emergence of a new educational model termed Massive Open Online Courses, abbreviated hereafter as MOOC(s). First appearing in 2008[2], MOOCs are known for their diversity of content, facilitating widespread access to new knowledge and skills in a variety of disciplines. Student registration generally does not involve exclusive prerequisites or a precise academic level; aspects that democratize access to knowledge according to numerous researchers around the world [3].

MOOCs, as an emerging paradigm of mass knowledge dissemination, gained substantial ground within learning methods over the course of 2012, which was proclaimed "The Year of the MOOC" by the New York Times. Since then, decision makers in the field of higher education worldwide, both Anglophone and Francophone, have been profoundly attracted to its "new" learning technology and have ended up producing several MOOCs in their establishments while portraying them as a means of reducing course fees, especially in underdeveloped or emerging countries such as Morocco [4].

In view of the current constraints on the Moroccan higher education system, pedagogical innovation has become a near necessity in order to meet the challenges, given the setting [5]. In particular, these challenges include a continuously growing mass of students, especially in open access establishments such as the Dhar El Mehraz-Faculty of Sciences in Fez which suffers from an occupancy rate which has reached 111% [6]. In addition, the diversification of its characteristics quantitatively and qualitatively, the heterogeneity of learners' levels, the abundance of new technologies and the limits of its infrastructure are also issues that become apparent with a cursory glance.

Numerous authors indicate that "innovation (in pedagogy) concerns everything that is not part of formal education". For example, Bédard and Béchard, emphasize that innovating should ideally mean "seeking to substantially improve the learning of students in interactive situations" [7]. In this regard and in order to support its face-to-face courses and to open up to its environment, in 2019 the Dhar El Mahraz Faculty of Sciences at the University Sidi Mohamed Ben Abdellah of Fez (USMBA) launched the first edition of its scientific MOOC, entitled "Traditional Moroccan Phytotherapy and Pharmacopoeia: PPTM" as part of the MUN project.

In this paper, we share the experience of the adoption of MOOCs by the USMBA by setting out the approach followed, the material and human resources assembled and the financial means put in place to carry out this first experiment as well as the results obtained.

This paper is divided into four main parts: the first section is dedicated to introducing MOOCs, their types and teaching methods by presenting the current situation of distance education in Morocco, the advantages of MOOCs and some feedback from African universities. In the second section, we give an overview of the means, methods and resources used. The third section is devoted to the presentation of the results.

Finally, the fourth section is dedicated to a discussion of the results, limitations and lessons learned from this initial experience— synthesized in the form of recommendations.

2 Fundamental Concepts and Literature Review

2.1 MOOC: Introduction and main models

In the context of democratizing knowledge and information sharing, the field of distance education has experienced a revolution in recent years with the appearance of Massive Open Online Courses. The concept took shape in 2008 with an initiative by Canadian researchers George Siemens and Stephen Downe, who launched a MOOC entitled "Connectivism and Connective Knowledge" which was highly acclaimed[8].

This innovative pedagogic model differs from that of conventional distance education by its receptivity to the general public and its open access. Thus, without any prerequisites or precise academic levels, anyone seeking to improve their knowledge and skills can register and take a place among the learners.

In order to guarantee a better educational experience, MOOCs offer a set of educational resources such as video and text lessons[9], allowing learners to be assessed through quizzes and problem-solving assignments as well as individual or collaborative projects. They also offer means of interaction between learners, such as online discussion forums. All these advantages have made MOOCs an emerging field in human learning environments and have attracted the attention of several academic researchers[10][11]. However, MOOCs can take several forms, namely xMOOCs and cMOOCs. In what follows we present the specific characteristics of each of these two types.

xMOOC: Present a structural model similar to that of formal and traditional academic training, where course design is undertaken with regard to participants fitting a specific profile[12]. This is essentially a course written by a teacher and posted online. Through such a course, the teacher transmits their knowledge to a large number of learners through videos, exercises, training activities, multi-media resources, etc. Knowledge is contained in the course content, structured and defined in a consistent and progressive manner. Most MOOCs offered by MOOC platforms are xMOOCs.

This similarity to traditional academics can be an advantage for participants in an online course because they are familiar with its structure and associate it with clear lesson plans and specific objectives (See Figure 1). However, this structure is not adapted to the diversity of participants in a MOOC and therefore offers no fresh solutions or updates to accommodate its new characteristics. With this model, universities offer the same course as always for different situations, effectively squandering an opportunity to upgrade and pursue structural change.

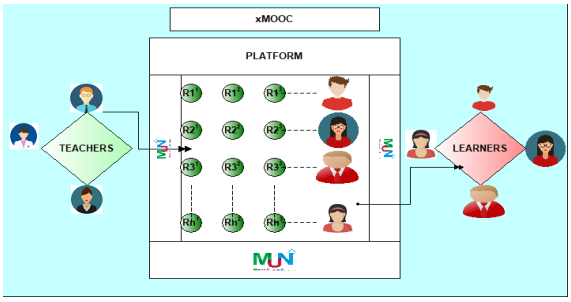

Fig. 1. xMOOC model

cMOOC: Unlike xMOOCs, they are based on a collaborative approach. Each learner carries out their own information research, exchanges findings with their peers and publishes their own conclusions. With this model, the emphasis is on distributed and self-taught exploration of knowledge rather than on the expertise and knowledge of teachers[13][14]. The first MOOC on the theory of connectivism is considered a typical cMOOC as it was fully adapted to the new form of network learning and represented an opportunity to break with tradition.

This is the case for the university learning model. However, this is a model that has not been integrated for several reasons: Teachers have no experience of informal training and it is difficult to determine the specific objectives of a course in advance and therefore to evaluate its results. In addition, the courses do not have a planned design, which can lead to disorientation, contrary to the order of formal training.

The figure 2 illustrates that each participant (P) generates resources (R) which are shared with the others. This structure is typical of the environment known as Web 2.0.

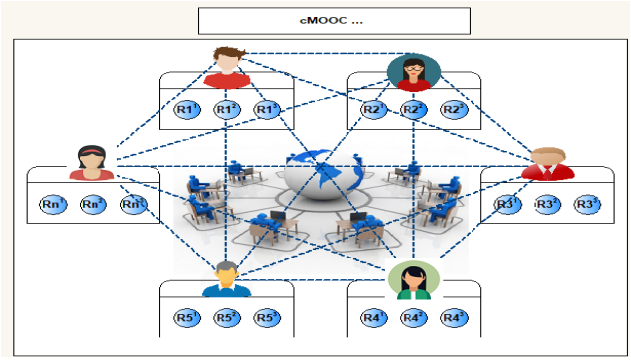

Fig. 2. cMOOC Model

Through their diversity and openness, MOOCs are becoming increasingly essential, not only in university circles but also in the field of professional and entrepreneurial training. Of great significance is the number of companies that have emerged with MOOCs and offer qualifying distance training—one might cite Coursera, Udemy, edX and a number of others[15]. In what follows we present figures detailing the

situation of higher education in some so-called emerging countries, in particular Morocco.

2.2 Higher education in emerging countries: the Moroccan case

Today, Moroccan higher education is developing at the intersection of national and international requirements. Following the enactment of Law N° 01.00, training at Moroccan universities has made remarkable progress, thanks to commendable innovations, particularly the massive expansion of infrastructure. In order to meet diverse and urgent social needs, higher education is increasingly sought after. The most important element is recognition of the need for quality training, which allows future bread-winners to acquire all the assets necessary to cope with professional life and the job market[16].

However, the widespread overcrowding in question jeopardizes the successful implementation of the reform[17], which is not conducive to widening the scope of high-quality education, the success of large numbers of students or the attractiveness of universities.

The first indicator is reflected in the gross enrollment rate for higher education in Morocco, which was only around 32% in 2016. Morocco's enrollment rate is in fact doubled by certain nations which had previously reported similar rates, such as Jordan and Algeria. The second indicator is attached to the educational framework, While the third indicator is linked to the rate of use of accommodation capacities (See Figure 1, Figure 2 and Figure 3).

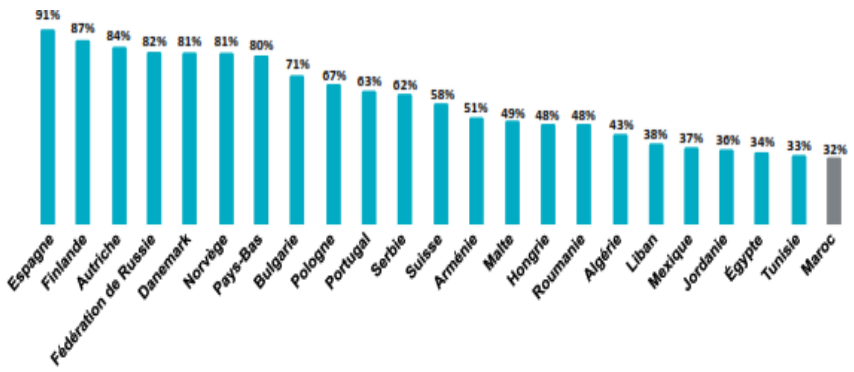

Fig. 3. Gross enrollment rate in higher education by country, Source: UNESCO raw data, 2016 - INE-CSEFRS processing[18]

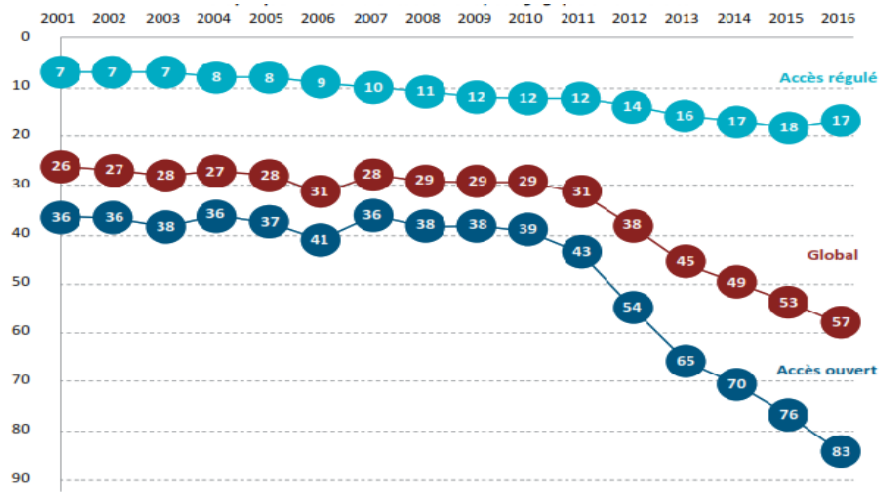

Fig. 4. The Pedagogical supervision rate at the university, Source: MESFCRS raw data - INE-CSEFRS processing[18]

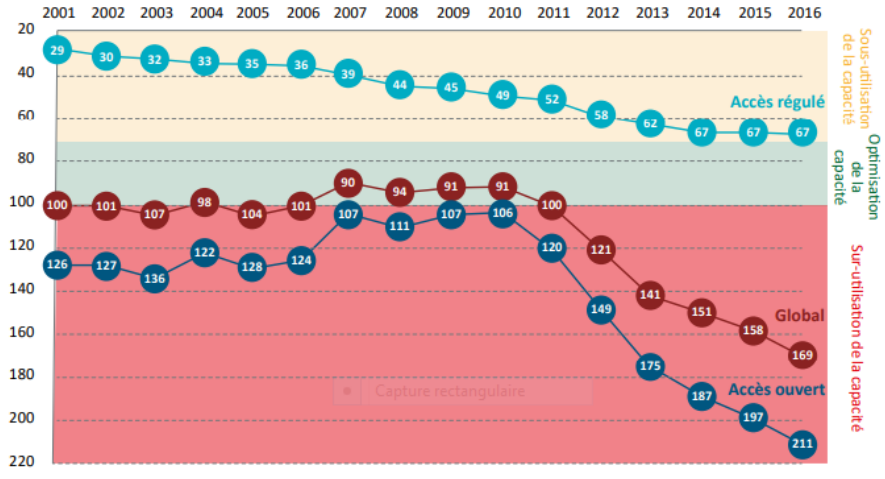

Fig. 5. University capacity utilization rate Source: MESFCRS raw data - INE-CSEFRS processing[18]

Capacity, in terms of physical seating, in Moroccan universities increased by 70.2% between 2001 and 2016. The data show that the increase in the availability of physical places in Moroccan universities between 2001 and 2016 remains insufficient to cope with the sharp increase in the number of students in university establishments, which reached 186.7% during this same period. This shortcoming in seating capacity during a clear phase shift with a surge of incoming students induced an over-use of this capacity whose rate of use exceeds all the standards for quality higher education. Although the university's capacity utilization rate hovered around 100% between 2001

and 2010, it has since continuously worsened as a result of the increase in the number of graduates, reaching 169% in 2016.

Given the large number of open access university establishments, which have grown steadily over the years, the public strategy to improve the offer of physical places in these establishments remains undefined[19].

The considerable increase in the number of students was accompanied neither by a significant development of human resources nor of consistent logistical investments, which led to a very low supervision rate and a drop in the completion rate associated with university studies[20].

2.3 Relying on MOOCs: What are the benefits?

Given the outliers regarding MOOCs, a kind of "media-hype" has slowly taken hold; some speakers indicate that such courses will completely change higher education, offering free, quality university education above all else[21]. Others suggest MOOCs are the cure for higher education for disadvantaged and lower income populations in developing countries. Furthermore, others admit that MOOCs offer the possibility of new means to further support learning. In the interest of analysis, the main advantages offered by MOOCs can be grouped into two categories: advantages vis-à-vis learners and advantages vis-à-vis universities and higher education institutions.

Advantages for learners: MOOCs are open to anyone with access to the Internet. They offer free online courses and make higher education accessible to a much larger audience[22]. Learners from all over the world can take courses at the most highly-regarded universities, regardless of geography[23]. Students no longer have to go to campus or pay high tuition fees to take courses at elite universities.

MOOCs are an excellent lifelong learning mechanism[24], and users range from adolescents to retirees. According to Belanger and Thornton[25], learners follow MOOCs for the purpose of gaining additional training, increasing social experience and intellectual stimulation, enjoying convenience and overcoming the barriers of traditional educational options. This allows motivated learners to develop their own educational path and at their own pace[26].

Even face-to-face students can benefit from MOOC online material. Some teachers reorganize their courses to allow their students to read the lessons online first and later meet face-to-face for interactive projects[27]. Such an arrangement allows face-to-face students and MOOC learners to interact with each other. It should be noted that interaction is highly effective for improving training results.

Advantages for universities and institutions: MOOCs have aroused considerable interest from policy makers, higher education institutions and organizations due to several benefits [28]. Carey in [29] argues that MOOCs help higher education decision makers to experiment with low-cost, low-risk forms of education. In addition, many institutions became involved with the MOOC experience in order to develop new potential sources of income [28]. Business organizations provide an MOOC-based platform and develop partnerships with institutions to penetrate the higher education market and explore new modes of delivery in higher education [28].

In addition to the aforementioned stakeholders, MOOCs can encourage teachers to pay more attention to their teaching methods. They give teachers an opportunity to re-examine their own teaching practices so that they can maintain or improve interactions with students. Additionally, faculty can potentially draw on MOOCs for professional development [30]. Moreover, according to [31], MOOCs could increase the visibility of the faculty among their colleagues and the general public, increase their earning capacity and help them obtain tenure.

2.4 Observations on the adoption of MOOCs in Africa

With reference to all of the aforementioned advantages of MOOCs, they are steadily being adopted on a large scale, particularly by universities that have faced challenges accommodating large masses of learners and those seeking increased international receptivity.

According to a wide range of research[32][33][34], African countries are an exception, as a modest or even negligible number of universities have embraced MOOCs as an alternative to offer and maintain distance courses. This situation has led researchers to take an interest in identifying the causes, constraints and limits which have discouraged progress toward the adoption of MOOCs in African universities. In this section we provide an overview of several MOOC projects launched in Africa while seeking to assess the possibility of implementing this educational model in a socio-economic environment under development, such as Africa.

The University of Abomey-Calavi through its partnership with the Ecole Polytechnique Fédérale de Lausanne (Federal Polytechnic School, or EPFL), has built its platform for the use of MOOCs via the Intranet. This platform currently comprises around twenty MOOCs from the Ecole Polytechnique Fédérale in Lausanne. Indeed, the EPFL through its MOOC for Africa program, offers to develop African universities' MOOCs by supporting them in the production process. The MOOCs for Africa project take into account universities in Benin, Burkina-Faso, Cameroon, Côte d'Ivoire (Ivory Coast), Senegal and Tanzania. The three axes of this project are the development of content for the Master's Degree and Doctorate, the training of African teachers in new ICTs for teaching (particularly MOOCs) and finally, to offer Internet access to students in the university campus precinct [35].

In October 2015, the first MOOC dedicated to the management of protected areas in Africa (GAP) was launched. With more than 7000 students including more than 400 having successfully completed the course, 116 countries were represented (65% of participants in Africa with a satisfaction rate of 97%). This online course was produced with the support of three partners involved in conservation, IUCN PAPACO and its partner IUCN France (International Union for Conservation of Nature and the Program on African Protected Areas & Conservation), André & Rosalie Hoffmann and EPFL, each of the partners providing technical, logistical, financial or academic support to the project [36].

With the completion of the MOOC studio in Abidjan, the Virtual University of Côte d'Ivoire embodied an important part of the national "MOOC Factory" project piloted by the Côte d'Ivoire Ministry of Higher Education and Scientific Research and

developed in partnership with the Agence Universitaire de la Francophonie (Francophone University Association) and EPFL through its Africa MOOCs program. On May 1st, 2017, the Africa MOOCs program joined the EPFL Center for Cooperation and Development (CODEV). As such, Africa MOOCs benefits from the expertise and know-how of a center which has broad experience in cooperation and development with emerging countries, while bringing its specific skills to the development of digital education [37].

Another example is the World Bank's "New Economy Skills for Africa: Information and Communication Technologies", or NESAP-ICT program. NESAP-ICT has supported the development of so-called Software, Mobile Applications, Research and Technology (SMART) knowledge centers in Tanzania as a model for the preliminary acquisition of relevant ICT skills that are sought by the local IT sector. With the support of the World Bank, the country has also launched a pilot initiative aimed at integrating Coursera training courses as part of a broader initiative aimed at equipping students with skills adapted to the market [38].

EPFL and Mohammed VI Polytechnic University (UM6P) in Morocco have launched a new online learning portal including 41 MOOCs developed at EPFL. This platform is the first fruit of a partnership agreement concluded between the two institutions shortly before the COVID-19 epidemic. It could eventually open up to students from other engineering schools in Morocco. In the future, the platform built by EPFL will welcome new MOOCs developed at UM6P and, later, at other African universities. In the longer term, UM6P could serve as a central hub, developing and publishing online courses for learners from across the continent.

3 Methodology and Equipment

3.1 The “traditional Moroccan phytotherapy and pharmacopoeia: pptm” MOOC is a groundbreaking experiment from the university of fez

The MUN project: On July 15th, 2016, an agreement on the creation of the "Morocco Digital University" (MUN) platform was signed between the Moroccan Ministry of Higher Education and Research, France Digital University (FUN) and the French Embassy. The purpose of this agreement is to set up a white label/ co-branded Moroccan platform operated by France Digital University to allow Moroccan universities to develop MOOCs, SPOCs or any other form of online course.

This project is part of the efforts made to widen the use of information technologies in higher education and, therefore, to take up certain challenges linked in particular to overcrowding in universities, the quality of training and integration of young graduates.

After a call for projects made by the Moroccan Ministry of Higher Education with various Moroccan universities, 49 MOOC projects were selected (out of a total of 119 submitted) to be the first MOOCs present on the platform when it was officially launched.

With respect to Sidi Mohamed Ben Abdellah University, four MOOC projects were selected out of six, three of which were from the Dahr El Mahraz Faculty of Sciences. Among the three selected was the MOOC entitled "Traditional Moroccan Phytotherapy and Pharmacopoeia" which forms the subject of this study.

Overview of the "PPTM" MOOC: Objectives and perspectives: The general objective of this MOOC was the teaching of phytotherapy and the traditional Moroccan pharmacopoeia. Herbal medicine is the art of healing with medicinal plants and involves improved awareness of different therapeutic plants and their uses. As for the traditional pharmacopoeia, this involves a list detailing natural product, especially plants, used before the appearance of modern synthetic drugs. This MOOC (https://www.mun.ma/courses/course-v1:USMBA+USMBA003+session01/about) provided both theoretical and practical knowledge of medicinal plants and phytotherapy in general. This includes the essential vocation of transmitting and perpetuating traditional and modern knowledge around medicinal plants and their myriad applications.

At the end of this comprehensive training, learners should have:

- Acquired knowledge in the field of traditional Moroccan pharmacopoeia and phytotherapy.
- Adopted a scientific, safe and ethical approach in the field of usage and development of plants.
- Become informed on public interest in and the limits of the dietary supplements and phytomedicines existing on the Moroccan and international market.

3.2 Research objectives and questions

This MOOC was an interesting opportunity for scientists and professionals in this field to take stock of the strengths and opportunities for applying phytotherapy. This area, which is topical on both a scientific and economic level, tends to meet the needs of the market in terms of interest in medicine and dietary supplements. The objectives of launching such an experiment can be grouped into three main areas.

With regard to the establishment, on one hand, this MOOC aimed to contribute to research training at the same level as doctoral training and offer visibility to internal skills as well as to research in this field. On the other hand, the strengthening of international receptivity through the training of learners around the world and the contribution of various ideas relative to their countries' respective backgrounds consequently sparked a certain synergy which united the skills of the team of teachers and researchers with those of the presidency.

Concerning the teaching team, the experience aimed not only at using the MOOC to widely disseminate the themes of phytotherapy and the traditional Moroccan pharmacopoeia, but also at the involvement of a research team in the design of content, in the prospect of encouraging the team to innovate in the pedagogical approach provided within the framework of this thematic, compared to face-to-face learning.

Lastly, via this MOOC, we primarily sought learner profiles who would show persistence, commitment and a drive to complete the course and earn the certificate.

3.3 Characteristics and specifications of the "PPTM" MOOC

Target audience: This MOOC was intended for health professionals (doctors, pharmacists, veterinarians) and scientists, with solid knowledge in physiology, nutrition, chemistry and biology. These learners completed a questionnaire concerning their academic level, profession, age, gender, education, etc.

Duration: The MOOC took place over 8 weeks structured in four sequences, during which each learner was trained in the recognition of plants, their medicinal uses and their potential effects in addition to the precautions to take with the use of medicinal plants as well as several other aspects of learning and discovery.

Educational resources available: Several educational resources were developed during the 8 weeks of the MOOC, including PDF, PPT, Word documents and course scripts written by the educational team. In addition, several videos of 5 to 8 minutes in length were designed (29 in total), including 2 introductory videos for the MOOC and 27 others related to each section of the MOOC. In this context, 78 documents were attached to the sequences of the course to reinforce it and provide additional explanations to those given by the teaching team. The Table 1 summarizes the proposed content.

Table 1. Pedagogical content

Content / Week number	Video Courses / PDF	Course Supplement Materials
Week 0	2	--
Week 1	4	10
Week 2	4	12
Week 3	3	10
Week 4	4	12
Week 5	4	14
Week 6	6	15
Week 7	2	5
Week 8	--	--
TOTAL	29	78

Evaluation methods: In this MOOC, an evaluative approach that was both formative and summative was applied to the learners from the beginning of the training until the end. With this in mind, the assessment of the degree of skills acquired by the learners during the training and the skills necessary at the end of the training to obtain certification were carried out with regard to the objectives set.

Moreover, at the end of each week, there were weekly quizzes to monitor the learners' knowledge acquisition. These quizzes were open from the start until the end of the course. They accounted for 35% of the final grade. Similarly, training quizzes and exercises were used to test and gain understanding of the platform's various components. These training quizzes were also scored as a 15% bonus to the final grade. A final quiz which counted toward 50% of the final grade was also carried out.

Weekly quizzes and training quizzes were accessible from the start until the end of the course. The Table 2 summarizes the evaluation content.

Table 2. Evaluation content

Evaluation / Week number	Training quiz	Weekly Quiz	Final Quiz
Week 0	--	--	--
Week 1	2	1	--
Week 2	2	1	--
Week 3	2	1	--
Week 4	3	1	--
Week 5	3	1	--
Week 6	6	1	--
Week 7	1	1	
Week 8	--	--	1
TOTAL	19	7	1

In summary, the final grade consists of:

- Weekly quizzes: 35%.
- Final quiz: 50%.
- Training quizzes and exercises: 15% (bonus).
- The certificate is free and accessible to all.

Hosting platform: As mentioned above, the PPTM MOOC was part of the MUN project which was in collaboration with FUN. FUN offers its MOOCs via the widely-known Open edX platform, which is one of the most acclaimed and innovative Learning Management Systems (LMS) on the market. This platform allows users to create interactive online training content and MOOCs. This powerful technology is used by several major MOOC players including FUN and edX[39].

As a leading open source LMS platform, Open edX features more flexibility, creative potential and receptivity as well as the cost of acquiring software and running Open EdX Platform on a server, which is free.

The platform is composed of:

- Open edXstudio, the tool for creating courses
- Open edX LMS, the interface through which learners (or MOOCers) access content. The Open edX platform is developed with the Django web framework, which is based on the Python language and uses Mako templates.

Figure 6 shows a view of the openEdx platform interface.

MOOC publicity strategy: In order to increase the visibility of the MOOC and improve tutor / learner communication, the MOOC teaching team created a communication committee. The objective of this committee was the development of a plan for the dissemination of information concerning the MOOC, whether in terms of the start of each sequence of the course or of events related to it.

In order to carry out its tasks, this committee also created two communication channels on social networks, namely Facebook and Twitter. These two networks were used as less formal communication tools but are well-suited to new trends and the current orientation of learners, especially young people.

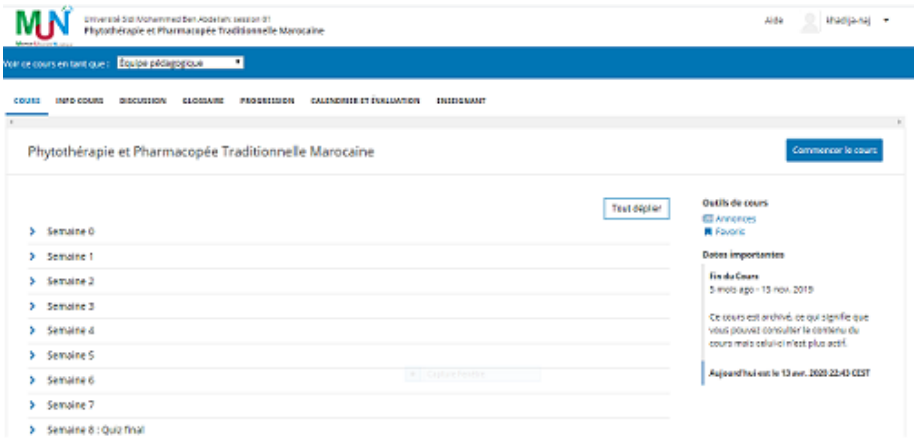

Fig. 6. The header image of online-journals.org

3.4 Resources deployed

Human resources: Any MOOC development process requires an educational staff with very diverse technical and educational specialties, and therefore, the choice of profiles can directly influence the quality of the resources offered.

One of the special features of our MOOC is that it is part of a collaborative project, which is why we have formed three steering teams. The first was the pedagogic teaching team, with 12 people, intended to ensure the coordination, the creation of the teaching content, the scripting, the evaluation methods and the animation of the course. The second team was the administrative and multimedia team, with 6 people, this team was responsible for the technical part of the MOOC, from the editing videos to the production of digital resources on the platform.

Lastly, the third team was made up of contributors who gave lectures to enrich the MOOC's topics through their relevant knowledge and skills, which was of great added value.

Equipment and Cost: To begin the development of a distance course, it is necessary to conceptualize a "process", scripting, structuring of chapters and providing information gradually as the MOOC progresses. This research work allowed us to reflect first on the specific dimensions of the distance course, in this case the MOOC, to have a well-designed and structured course. To do this and to achieve the objectives of the MOOC, several technological tools have been put in place:

- A small studio at the Dhar El Mahraz Faculty of Sciences which consists ofCanon 760D camera, Tripod, Green Screen, Wireless Microphone and Teleprompter.
- Studio belonging to the Faculty of Medicine and Pharmacy at Fez (See Figure 7).
- Teachers' own cameras and smartphones.

Fig. 7. Studio at the Dhar Mehraz Faculty of Science

For project management, media coverage, the purchase of computer equipment and studio equipment, the Dhar Mahraz Faculty of Science relied on the grant awarded by the MESRSFC (Ministry of Higher Education, Scientific Research and Management Training) to the selected MOOC projects, amounting to 50,000 Dirhams for each. It pooled its resources between the Faculty's 3 MOOCs selected by the MUN project and worked with a common budget of 150,000 Dirhams.

4 Results

In this section of the paper, we present the feedback from the first experiment conducted by Sidi Mohammed Ben Abdellah University.

On the path toward the adoption of MOOCs, we present a set of statistics related to learners registered in the MOOC including learner profiles, demographic information, motivation, learner engagement and especially certification rates.

4.1 Enrollees: Profiles and demographic information

The MOOC bought 465 registrations, a number that remains very satisfactory for a first experiment. The majority of the learners were men, with 263 registered. As for the women, there were 200 registered, without forgetting 2 people who did not mention their gender (See Figure 8).

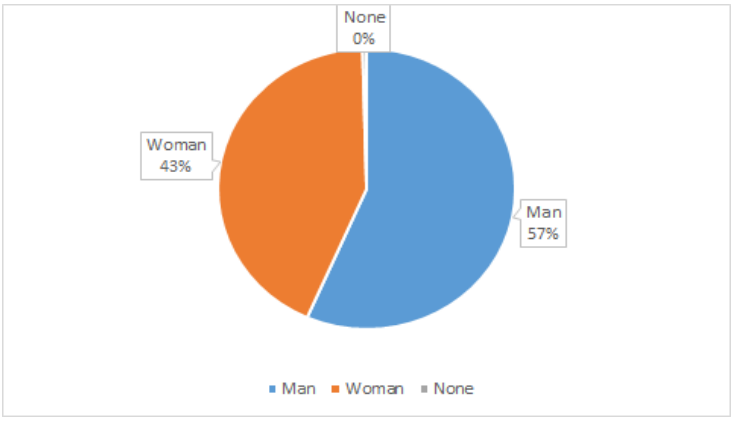

Fig. 8. Relative gender frequency of registrants

In terms of the distribution of learners by age, the graph in Figure 9 shows that 73.76% of those enrolled were young people, students or recent graduates whose ages fall between 18 and 35. Also 102 participants were positioned in the age range of 36-55, which represents 21.93% of the total number of enrollees. We also note that only one person was over 65. The Figure 9 shows the number of enrollees in the MOOC by age group in detail.

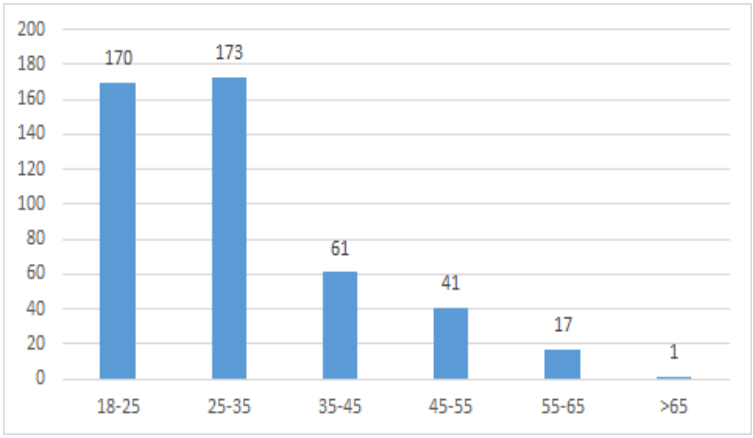

Fig. 9. Number of enrollees in the MOOC by age

Concerning the academic levels of the learners, we note following Figure 10 that most of the learners registered in the MOOC had a master's degree (171 people), followed by 101 registered with a higher education diploma and 99 learners with a doctoral degree. We can clearly see that the audience interested in our MOOC is primarily made up of people with high academic levels.

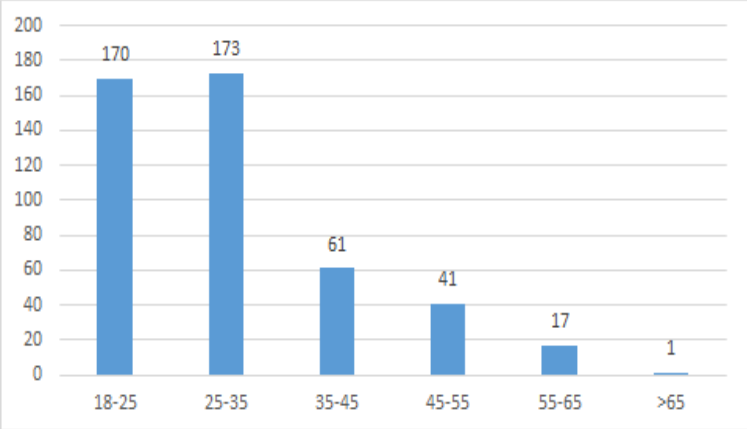

Fig. 10. The academic levels of the learners

In terms of geographic distribution, the registered learners came from 13 countries around the world, the majority from Morocco, with a relative frequency of 94.26%, followed by France with a frequency of 3.01%. Table 3 shows the number of learners and their percentage by country.

Table 3. Numberoflearnersandtheirpercentagebycountry

Country	Absolute Frequency	Relative frequency
Burkina Faso	1	0.22%
Benin	1	0.22%
Brazil	1	0.22%
Republic of the Congo	1	0.22%
Algeria	1	0.22%
Spain	1	0.22%
France	14	3.01%
Ghana	1	0.22%
Morocco	440	94.62%
Niger	1	0.22%
Russia	1	0.22%
Togo	1	0,22%
Missing value	1	0,22%
Total	465	100,00%

4.2 Motivation for enrolling in the MOOC

Among the most important things to know to properly lead and supervise the participants in a MOOC is their motivation for enrolling. This information will undoubtedly facilitate understanding and energize the alignment of the participants' objectives with those of the course leaders.

For the subject MOOC, participants' responses were very diverse. After an in-depth study, we extracted a number of reasons that motivated people to enroll in the MOOC. Following is an exhaustive list of information found:

- Interesting and topical subject.
- Being part of a community of experts.
- Acquiring new skills/ knowledge.
- Lack of university support.
- Career development or reorientation.
- Certification and partaking in a new online learning experience.

4.3 Learners' weekly commitment

To assess the progress and knowledge gained by these learners, the PPTM MOOC was processed through a formative evaluation via a set of quizzes as presented in section 3.3 of this paper. This included two types of educational training quizzes that paralleled the relevant concepts and weekly assessments. In addition, a summative evaluation was carried out at the end of the MOOC to measure the learners' assimilation of knowledge.

The following graph (Figure 11) shows the engagement of learners in general over the weeks of the course. They responded to the assessments on time. We have observed that the percentage of learners who started the MOOCs on time represents only 24.30% of the total enrolled. This percentage continued to decrease to 18.49%, 15.05%, 14.19% respectively for weeks 3, 5 and 7.

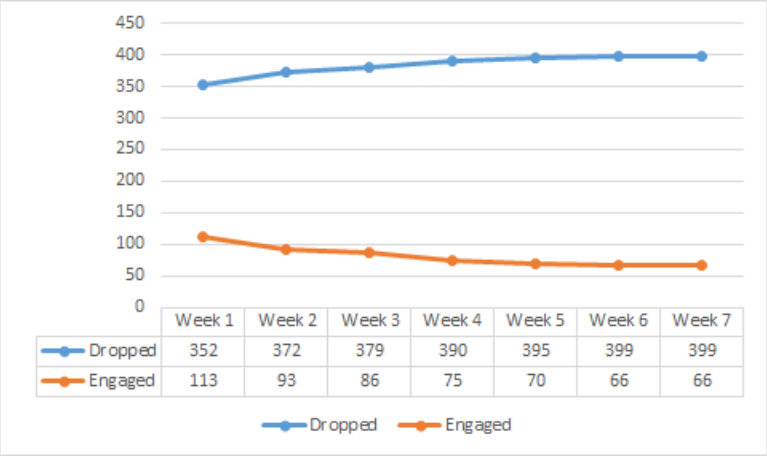

Fig. 11. Engagement of learners over course's weeks

For more details, Figure 12 shows the number of learners and their commitment to the weekly assessments separated into three classes, namely those who did not submit

the requested work, those who tried but did not have the grade required to pass the evaluation and those who passed the weekly evaluations.

We observed that, on average, only 65 learners passed all of the assessments and 17 of them encountered difficulties and therefore failed. This figure also shows that the number of learners not engaged in assessments was around 384 learners.

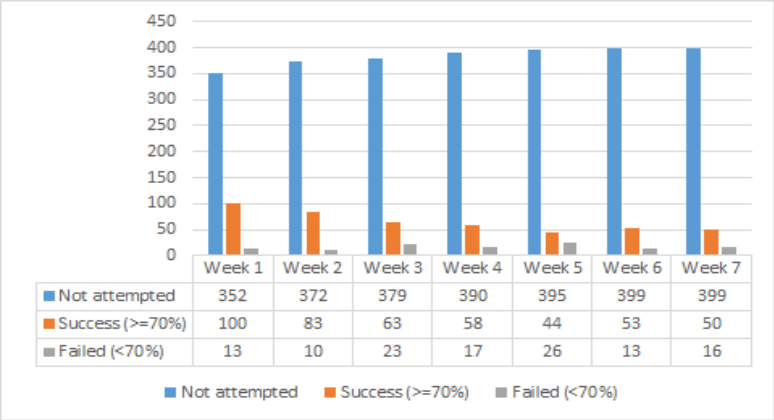

Fig. 12. Number of learners and their commitment by week

With regard to training quizzes, Figure 13 also illustrates the number of learners segmented into three classes and their level of engagement. This graph has been taken into account in order to provide a more detailed view of the learners' commitment to the whole course, since the training quizzes are aligned with the videos and other available educational resources.

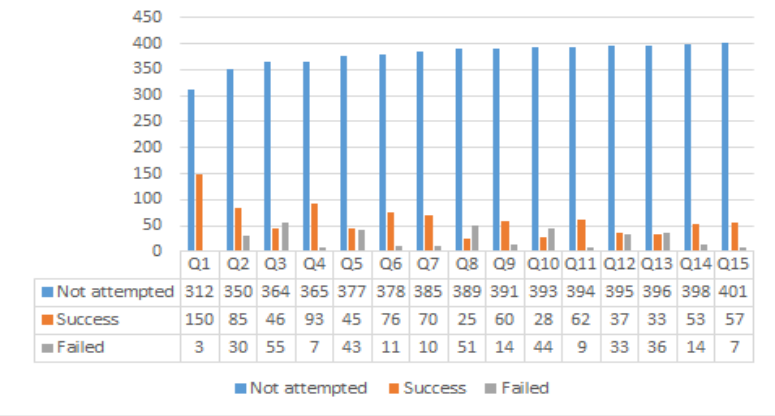

Fig. 13. The header image of online-journals.org

4.4 Certification

In order to be considered certified by the PPTM MOOC, the designers of the MOOC set a 70% threshold for the success / pass rate relative to the scores on the training evaluations, including weekly quizzes and the final quiz. In this section, we present the profiles of learners who earned the certificate, a total of 57 people who represent a percentage of 12.25% of the total number enrolled. Admissions are distributed between 22 women and 35 men as shown in the figure in percentages (See Figure 14).

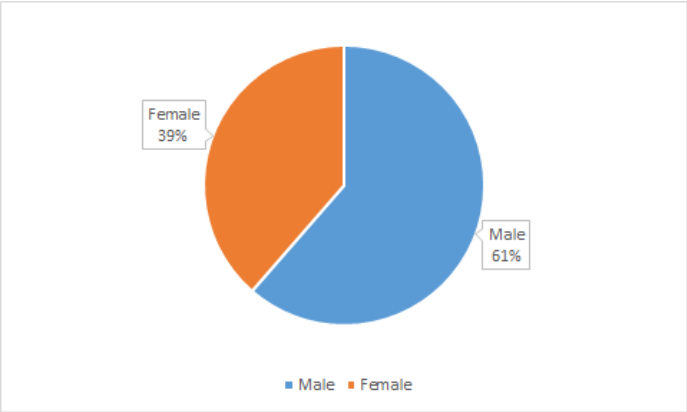

Fig. 14. The header image of online-journals.org

A breakdown of the learners by age, Figure 15, shows that they are mainly concentrated in the 18 - 35 age bracket. More precisely, 36.85% were learners between 18 and 25 years of age, a demographic very close to that of learners between 26 and 35, who make up 40.36% of successful graduates.

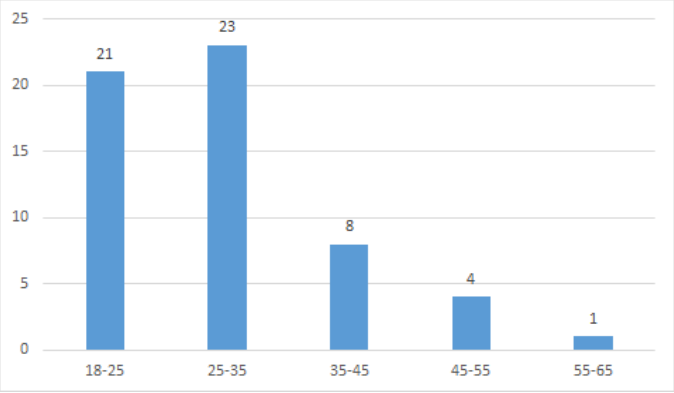

Fig. 15. The header image of online-journals.org

With regard to the geographic distribution of learners who attained the 70% threshold need to pass, we noted that more than 55% were from Morocco, including 50.87% from the city of Fez, followed by Kenitra with a percentage of 7.01% and then Agadir, Meknes, Rabat and Taza—each accounting for 5.26% of certifications.

Regarding successful participants from other countries, one learner from Ghana and one from Italy (each accounting for 3.508%) earned the certificate. The graph in figure 16 shows the number of learners who certified by country.

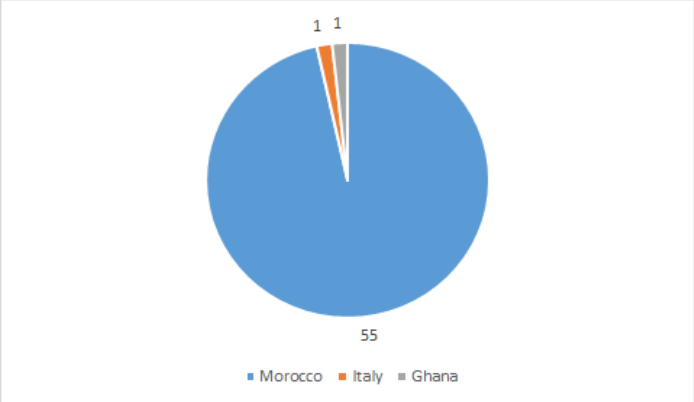

Fig. 16. The header image of online-journals.org

5 Discussion, Limitations and Recommendations

According to[39], there is no doubt that MOOCs are being adopted by African universities because they reduce the need for expansive educational infrastructure which remains prohibitively costly. In addition, MOOCs eliminate the cost of accommodation and transport for students and, above all, they allow access to a wide demographic, involving tuition fees within reach of the most disadvantaged students, or often no fees at all.

Even if the number of participants was rather low for this type of MOOC, as it was intended for an audience of specialists and requires basic knowledge in physiology, nutrition, chemistry and biology, the course addresses a practical and uncommon subject, which should be recognized as an important aspect of its appeal. Moreover, this falls in line with the objectives and the results expected by the MOOC's educational team, including the wide dissemination of the Phytotherapy and Traditional Moroccan Pharmacopoeia themes, in Morocco and elsewhere.

Admittedly, the dissemination of knowledge within the framework of this MOOC remains very promising. However, the ICT infrastructure available to students can be seen as an obstacle to the success of such a digital project in an emerging country. Meanwhile, Internet penetration is increasing every year in Moroccan universities and ICT tools are becoming more and more accessible over time.

It is also important to note that the MUN project in general and this PPTM MOOC in particular are low-cost projects for which minimal financial and human resources have been allocated. Moreover, the impact and the results of this MOOC could have been greater if the budget had been increased.

After an in-depth analysis of this experiment, we recommend the commitment of all pedagogical entities, namely, learners, teachers and the establishment to work toward the successful integration of MOOCs in Moroccan universities.

5.1 Student engagement

MOOCs require effective and efficient commitment on the part of the learner, through the following actions

Preparation of the necessary tools (hardware and software resources) before starting the MOOC:

- Acquisition of prerequisites before starting the MOOC.
- Participation in the discussion forum with other learners.
- Punctual completion of the requested work and online tests with respect to the constraints of the MOOC.
- Effective time management and compliance with deadlines for submitting work related to the MOOC.

5.2 Teacher engagement

The commitment of teachers or the teaching staff is an essential asset for the proper implementation of MOOCs in higher education. This leads us to propose the following recommendations to teachers:

- Preparation of educational activities for learners before the launch of the MOOC;
- Supervision and close support for learners during MOOC monitoring.
- Development of a team of beta testers to assess the smooth running of the platform's features and functions.
- Presentation of the working methodology of MOOCs to learners.
- Communication of encouragement and motivational email to learners at the beginning of each week of the MOOC.
- Monitoring of learners' progress on the MOOC platform (online work, exchanges, suggestions and complaints).
- Sharing the teacher's experience with other teachers and/or teaching teams on the MOOC.
- Improvement and updating of teaching materials according to new methodologies relevant to the design of MOOCs.

5.3 Educational content

This refers to recent educational content, up-to-date and composed of a wide range of educational activities, representing the major needs and current expectations of learners. We recommend educational content that meets the following requirements:

- The MOOC must be at the learners' level, regardless of the subject's complexity.
- The MOOC must adhere to the standards of international MOOCs, including the duration of videos, quality of documents, availability of teaching aids, clarity of presentation, forum for exchanges between learners, etc.
- The MOOCs progression must be consistent and capable of adapting to the learning needs of the target audience.

5.4 Commitment from the establishment and the university

The higher education institution must make a commitment to facilitate the procedures for implementing the MOOCs. In addition, it must provide the appropriate working environment (hardware and software infrastructure, premises and availability of teachers). We offer the following recommendations to the establishment:

- Approval in principle of the agreements linked to the courses in the form of MOOCs between learners and teachers.
- Monitor the quality of service by developing evaluation sheets provided to learners at the end of a course, in order to obtain feedback and guarantee the smooth running of any future sessions of the MOOC.
- Ensure availability of all the equipment necessary for the MOOC to run smoothly.
- Improve management regulations and structure (MOOC duration, start and end dates, test dates and online assessment) for the proper functioning of the system in order to achieve effective learning.
- Monitor the operational continuity of the system in the event of withdrawal or malfunction of some elements of an educational entity.
- Disseminate MOOCs with educational content that is accessible to learners according to their needs and expectations as part of this new educational approach.

6 Conclusion

Inadequate infrastructure and student overcrowding of classrooms and lecture halls are the biggest challenges that Sidi Mohamed Ben Abdellah University continues to deal with by adopting a number of appoaches, including MOOCs.

This experiment with the opening edition of the first scientific MOOC, at the Dhar el Mahraz Faculty of Sciences, was indeed encouraging and provided an abundance of lessons to be drawn.

The PPTM MOOC is supported by the idea that digital technology in higher education and the use of educational innovations are means of facilitating course follow-ups and overcoming the obstacles of overcrowding and insufficient capacity infrastructure. Clearly, this reinforces the idea that we must continue to develop such projects at Moroccan Universities.

The analysis of users' navigational footprints, incomplete in this first experiment, will certainly allow us to better understand the learners, in particular their behavior and their preferences for the different lessons taught, in addition to how their tenacity and perseverance progressed over the duration of the course. These elements will be taken into account for the design of future editions of this MOOC which will be more learner-centric in order to offer students an improved MOOC environment with integrated learning analyses. Additionally, such aspects will be indispensable to the development of a comprehensive MOOC strategy and a suitable digital approach from Sidi Mohamed Ben Abdellah University.

7 Acknowledgement

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