Towards the development of a pedagogical approach using MOOCs in traditional classrooms to support teaching in higher education in MOROCCO

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***Abstract*— The introduction of the concept of e-learning or information and communication technologies in education has become unavoidable. Whatever the type of education provided (face-to-face or distance), the ICT, are now applied in different pedagogical situations at the university and have become likely to have an impact on the educational system. MOOC, a new form of ICT for learning, is an open access online course that has many inherent advantages over the standard educational pedagogy.**

This paper proposes to study the effectiveness of two methods of integrating MOOC in higher education system through two practical experiments that were conducted with two different subject and targeted publics. Results obtained shows that the both form of integrating MOOC, improves learning results, and have an influence on academic success of students; they made it possible to define the conditions for the successful integration of such a learning system, and to build an idea on its effectiveness, in the context of higher education in Morocco.

***Index Terms*— ICT, MOOC, distant learning, higher education.**

I. INTRODUCTION

The higher education sector has evolved significantly in recent years, as a result of a number of factors, which has impacted the learning practices of students with a digital culture. Those initiators have pushed the pedagogical practices of teachers to be questioned and specially to change. The world is now witnessing a transition from a Classical approach based on the transmission of teacher-centered knowledge to an innovative approach based on the appropriation of knowledge, and the acquisition of skills through active learning centered on the learner.

As a result of this new reform of higher education, Moroccan academic institutions are now facing a number of challenges

and find themselves in the obligation to rethink their teaching / learning modalities, in order to incite a massive student participation and highly innovative pedagogical practices integration. Given the growth of the student's number and the limitation of human and technical resources, such an evolution leads to raise simultaneously pedagogical, technological and organizational challenges. The Moroccan university must therefore succeed in facing the structural upheaval of new ways of accessing, creating and disseminating knowledge; it must consider to follow the train of such evolution which falls under the partial transition to the "all digital". Such actions have as their main objective the development of new forms of active and collaborative learning based on nomadic and ubiquitous course tools.

ICTs are now used in schools and universities mainly for educational purposes (course development, content distribution, communication between professors and students) and for informational purposes (student registrations, announcements of results and administrative support). The Moroccan higher education become aware of the emerging innovation based on the use of ICT for teaching, and start to call for the use of ICT for the management, the work process and also the training of educational personnel and students. In a learning context, ICT are an efficient way for both teachers

and students to gain wider and easier access to information, an increased opportunity for exchange with their peers and an opportunity to enriched interaction with other similar communities.

The development of MOOCs has changed the structure of traditional education by proposing new patterns of integration. There are many inherent advantages that an open online course has over the standard educational pedagogy that has been the norm for years now. In Morocco, many popular higher education institutions ventured into MOOC included Chouaib Doukkali University. This paper proposes to investigate different schemes of integration of MOOC into the university curriculum, and precisely in continuous training. For this purpose, two experiments were conducted with two groups of students from two different fields and levels of study. The objective is to validate the impact of the involvement of such digital devices in face-to-face training, but also to justify the appropriate integration scheme depending on the context of deployment.

This starts by enlightening the problem of higher education in Morocco face to numeric invasion, followed by a review of MOOC/SPOC theory. Secondly, the research carried out is presented with the researches relating to the integration of MOOC into the curriculum, experimental study, results, discussion and conclusion.

II. PROBLEMATIC AND STATE OF ART

A. Problematic

According to a recent report of Times Higher Education's world ranking of universities, only three Moroccan universities are listed and are therefore misclassified, since no Moroccan higher education institution has been ranked in the top 500, which means that the higher education situation in morocco is highly alarmist.

As part of the university reforms launched in Morocco, and in a continuous concern to improve teaching methodologies by promoting access to new communication and information technologies, the Moroccan university has decided over the past ten years to embark on the creation and implementation of digital workspaces. So that offer to both students and faculty staff the opportunity to access distance to a database, to share with teachers and student's administrative documents such as information about registration and marks [1][2].

On the pedagogical side, different Moroccan universities have recently decided to take place in the digital space, by introducing more and more ICT in teaching practices. This vision is not limited to the use of IT tools and the availability of practitioners in fact; new technologies of communication and information are currently in the deployment phase. The university creates its own identity by making digital frameworks, methodology for these pedagogies, and a new orientation to deal with several pointed problems. Such new perspectives reveal a number of questions related to the university's ability to embrace such development trend: [3]

- To what level is Morocco ready to follow such an evolution?
- Do Moroccan institutions really have a network and a technological and human infrastructure that make this type of educational system easily accessible?
- Do we already have qualified people to manage such systems?
- Does Morocco offer specialized training in pedagogical engineering?
- How to integrate successfully distance-learning platforms such as MOOCs into higher education?

To succeed in such a reform, initiated first at the level of higher education, it is necessary to create a new dynamic approach to learn and then to encourage teachers and students to actively use appropriate ICTs as learning tools. It is also necessary to articulate teachers' practices with the technological tools and the appropriate environment, the most meaningful for learners. All this requires a redesign of the way higher education actors and teaching practices operate.

The Higher Council for Education, Training and Scientific Research in collaboration with the national body for the evaluation of the education, training and scientific research system, published a paper (http://www.csefrs.ma/wp-content/uploads/2018/10/Rapport-Enseignement-sup--rieur-Fr-03-10.pdf) in 2018, which represents an evaluation whose purpose is to identify challenges at both the global and national levels of Moroccan higher education in order to provide the basis for a forward-looking vision and strategic development of higher education This evaluation concerns precisely the LMD system, i. e. since its application 15 years ago, no overall evaluation of the LMD has been carried out.

This report also highlighted the structural constraints of higher education in Morocco, these constraints have been summarized as follows:

Massification: gross enrolment rate in higher education

A proven pedagogical under-framing in open access: the report stressed the need for sufficient and closer supervision of students in small and homogeneous groups according to their

choices. In 2016, the management ratio has reached 57 students per teacher-researcher.

Infrastructure: out of phase between capacity and student numbers: The data indicate that the increase in the supply of physical places in Moroccan universities between 2001 and 2016 remains insufficient to meet the strong growth of the the strong increase in student numbers in universities.

Evolution of the budget and cost of the student: the budgets granted by the state did not increase compared to the increase in the number of students.

To synthesize, we can say that the development of the quality of the unregulated university system is hampered by the massification and inadequacy of the management ratio and infrastructure. Two dimensions that depend directly on the state's financial benefits.

In addition to all this, the university must address the need for a renewal of pedagogical practices and teaching methods. For this purpose, new student-centred ways of teaching are needed today: active methods such as project-based or problem-based approaches, simulations or case studies that make it possible to mobilize learners' transversal knowledge and involve them in their learning. It is also a question of accompanying them on the path to autonomy by emphasizing "learning to learn" by moving from pedagogy to heutagogy. Such objective can be achieved by using ICTE tools, but only if the pedagogical needs are identified and the technical resources and pedagogical devices that can effectively meet them are identified. teachers must therefore be supported in transforming their pedagogical practices: designing online courses and their scripting, developing digital resources,

The concept of MOOC encompasses these different ideas, and represents an inevitable future of the evolution and implementation of ICT in education.

In the next paragraph, we will discuss MOOC/SPOC, a new form of digital learning that is beginning to appear more and more in the education sector at all levels.

B. Open Online Course (MOOC/SPOC)

Before the digital age, distance education first appeared as a correspondence course in the 1890s and 1920s. A little later, radio and television began to broadcast courses and preliminary forms of online learning. The 2000s saw changes in online and distance learning, with an increasing online presence, learning opportunities began to open up, especially with the development of MOOC/SPOC [4], distance-learning platforms, open and with a free and wide access. Since then, several approaches have begun to be discussed currently the Virtual Universities [12] approach is already being debated.

a) MOOC: Massive Open Online Course

A MOOC [5], Massive Open Online Course, is an online course for unlimited participation and open access via the web. MOOC were initiated in the early 2000s by certain leading American and European universities. An integral part of the MOOC philosophy has been to provide open access to online learning. MOOC offers, in addition to traditional course materials such as videos, documents and quizzes, user forums to support interactions between students, related networks and teaching assistants. MOOC are a recent and widely studied development in distance learning introduced in 2006 and that emerged as a popular learning mode in 2012.

MOOC has been become an active research axis in education technology projects in recent years, attracting considerable media attention and inciting a massive academic research. It was published as an online platform, where learners can access using a web navigator and an internet connectivity. With the developments that Morocco is currently experiencing at the level of telecom technologies (3g / 4g and soon 5G), as well as the competitiveness between operators, the internet access and availability are no longer a problem.

Unlike the traditional principle of face-to-face courses, MOOC courses do not have formal accreditation. Designers propose a clear objective of participation and accreditation by transferring the "credits" of students who successfully complete online training to those of the university curriculum from which MOOC is branching out.

The MOOC represents a pedagogical innovation that potentially allows tens or even thousands of students or learners in continuing education to follow complete training in all fields at the same time and for a few weeks. In Morocco, several projects have been carried out for some time now, and which aim to spread digital culture within university educational institutions. In 2016, a convention for the development of the "Moroccan Digital University" (MUN) platform was signed between the Moroccan Ministry of Higher Education, Research and Executive Training (MESRSFC), in collaboration with the GIP FUN-MOOC and the French Embassy. The success of this project gave birth to two other versions, RUN2 and RUN3. In 2017, a call for MOOC projects was launched to contribute to the national MOOC platform, version 3 of RUN mainly aimed to present the progress of MOOC projects on the "Morocco Digital

University" platform, as well as to present the national strategy implemented by Moroccan universities and the organization of the MUN platform.

MOOC offers several advantages: Scalability, Optimal resource utilization, Self-paced …

b) SPOC: Small Private Online Course

SPOC (Small Private Online Course) is a private online course for small groups. The concept is defined as a hybrid evolution of MOOC for academic circles. A movement wants to re-adapt MOOCs in a local way [13]. It inherits the same concepts and same characteristics of the MOOC.

SPOC is considered as an evolution of MOOCs that was born following the too high dropout rate, indeed, the number of people registered on a MOCC who manage to follow a MOOC until its end remains low compared to the initial total number of registered people. The certificate obtained at the end of the training therefore does not seem sufficient to keep students on the edge of their seats. SPOC has therefore emerged as an appropriate solution: to allow better proximity between teachers and students as well as better supervision of learners. Above all, obtaining a diploma at the end gives more credibility to the SPOC formula.

The two models MOOC and SPOC are therefore more likely to lead to co-existence.

III. THE INTEGRATION OF MOOCS INTO UNIVERSITY CURRICULUMS: METHODS AND EVALUATION

Choosing to integrate a MOOC into a university training program requires a convergence of the local curriculum and the MOOC in terms of both content and planning. Thus, uniform pedagogical organization modalities are required to deploy a MOOC in this example of context.

There are many ways to integrate MOOCs into classroom teaching. First, it is possible to integrate MOOCs developed either by the institution itself, or by other institutions, or by other institutions but as part of a common program. Then, it is possible to use all or part of it. Finally, MOOCs can be used as a simple documentary resource or as a total replacement for a course, with all the imaginable intermediaries: in a reverse classroom system, as a prerequisite (for example, for a summer school), as an upgrade (for a doctoral school), etc.

The possible combinations are therefore very numerous. Many researches have contributed in this area, by describing different integration models through analytical and comparative studies. In fact, Integrating MOOCs into Traditional classroom settings is largely influenced by two elements of coupling and cohesion, as explained in [14].

Different integration models can be classified in term of student population, number of courses, duration of experiment, and adoption methods from a supplementary documentation to fully integrated courses in traditional classrooms.

MOOC can actually be offered in replacement of an existing module, or serve as a basis for the evolution of an existing hybrid course integrating line and face-to-face activities. It can be also used as additional training to a training course already performed in the classroom.

[6] describes the modelling of the MOOCs and their implementation of the process of integration, their work was a part of an experience of a private university group in Morocco, in the vision of establishing a new hybrid learning process that responded to very specific needs described at the beginning of the experiment. The work was submitted to a hybrid evaluation system that consider both motivation of learners and teachers. This approach was limited to local initial training curriculum of the group without having the opportunity to expand it to other continuing education. The authors succeed to prove that such propositions represent great stimulus for intellectual activities of professional mining engineers and encourage their desire for further self-education and implementation of obtaining skills at the working place.

Authors in [7] propose an approach based on incorporating MOOCs options into traditional classrooms. Authors share their instructional experience and show the benefits of introducing MOOCs options at the courses designed for retraining mining engineers and senior managers of coal enterprises.

Another similar approach was presented in [8], where authors investigated how high school students taking a university preparatory economics course would engage with the learning and assessment components of a behavioral Economics MOOC that was integrated into their school-based course. The authors proposed to integrate the MOOCs into school-based courses. However, they affirm that such operation may entail curriculum design challenges as classroom teachers need to find relevant content that enriches their existing curriculum. Another challenge is the persistence of an integrated MOOC over time. They propose that teachers need to examine carefully the added cognitive value of a MOOC, and that in case where an integrated MOOC is removed from its provider platform; the teacher may have to look for a replacement or abandon the integration.

In [9], Authors presented different experiments of integration arrangements that have been put in place in the last two years in a training program. They have implemented MOOCs incorporating existing content into their training courses, or as an elective course. It has been set up to put in place a procedure that allows a student to offer courses to be included in his study contract.
Authors in [15] propose to study requirements of a hybridization and MOOC implementation in an academic curriculum, and focus on studying MOOC for "project management", the studied MOOC model was applied to seven institutions involved in the MOOC project management. Authors demonstrate that various practices schemes of integration, adapted to the local context, show efficiency in the knowledge acquisition process.

The paper [16] present the results of a longitudinal study on the integration of MOOCs in university classrooms and their influence on academic performance. Authors study the influence of this type of participation through examining the standard instruments: TAM (Technology Acceptance Model) and IMMS (Instructional Materials Motivation Survey). They demonstrate that participation in a MOOC improves learning results, and that both of the type of course design (defined by an intensive use of social networks and e-activities) and active participation have a positive influence on academic success. They also identifies that hybrid and blended MOOCs should be the priority option for improving the learning of university students because they promote the attainment of positive academic results.

IV. EXPERIMENTAL INVESTIGATION IN CHOUAIB DOUKKALI UNIVERSITY

At the university level, researchers are still trying to provide answers to questions about the contribution and relevance of the use of ICT for teaching/learning in a context that allows them to be validated. In our case, we have tried to make both a contribution and a response to the effectiveness of the use of ICT in higher education, through the deployment of MOOCs and specifically SPOCs.

Indeed, SPOC (Small Private Online Courses), unlike MOOC, targets a limited number of pre-selected learners and offers training on specific subjects. The objective of this type of online training is to provide a more personalized follow-up than that offered by MOOC. SPOC focuses on practical application and exchanges with the trainer and between learners as well as on reworked classroom activities.

In Morocco, MOOCs are actively involved in business schools and universities, most of which have already signed partnerships with foreign institutions or participated in MOOC design projects in a particular context. However, certification is still not free of charge but remains accessible at low prices
It is with this in mind that several universities have embarked on the creation of courses in the form of MOOC/SPOC. The most well-known platform currently available is Moodle. Some universities have chosen to develop their own platforms in order to distinguish the knowledge offered. The problem remains the heterogeneity of content, since so far, the creation of MOOCs has been decntralized even within the same institution.
In this line, we have set up, experimented and evaluated two training courses: the first is a complement to face-to-face courses for master's students; the second is to reinforce the prior preparation of practical work outside the face-to-face sessions for second-year bachelor's students.
The proposed SPOCs provide interactive scripted content via the CloudSpoc platform [10] (accessible online via the link http://cloudspoc.ma) on the fundamentals of IPv6 for the first training and on the preparation of practical work in electromagnetism in vacuum for the second training. The objective of the conducted experiments is to evaluate the effectiveness of our proposed pedagogical scenario and the SPOC integration model via the various tests.

The first SPOC on IPv6 fundamentals

The integration of SPOCs in the training courses concerned by our experiences has taken two forms:
Additional training: IPV6 course
Prior Preparation to the classroom session: Practical work in vacuum electromagnetism.
Moroccan universities have not yet given their initial agreement to exploit the possibility of offering a MOOC/SPOC to replace straightforward classroom training. This means that the possible integrations remain to offer a MOOC either as a complement to training or as a preliminary preparation, or as an integral part of a course that is done in person.
We conducted two experiments on this first SPOC. The first was carried out with the participation of 17 students from a master's degree in "Telecommunications, Networks and

Industrial Electronics" who entered the doctoral cycle. The second experiment involved 41 students from a bachelor's degree who joined the common core of the specialized Master's degree "Instrumentation, Networks and Renewable Energies". The participants were invited to attend our SPOC course on "IPv6 fundamentals" (figure 1) consisting of a set of sequences spread over different weeks depending on the period of the experiment. Each participant, after logging in to follow the proposed SPOC, must respect a well-organized pedagogical scenario with various contents online (courses, tutorials,
practical workshops, entry/exit tests and remediation).

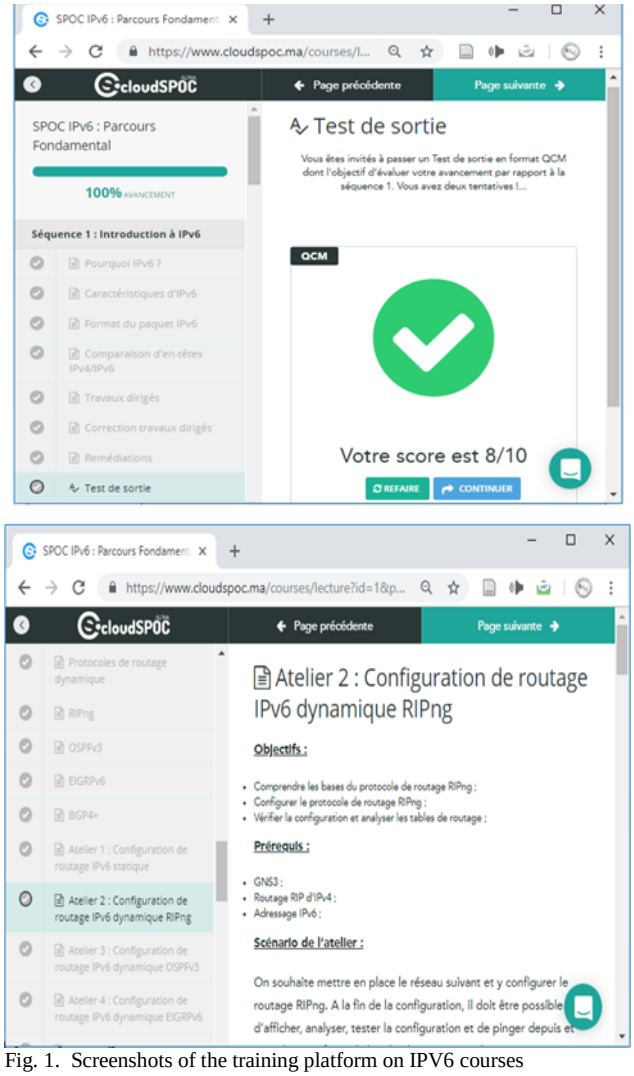

Fig. 1. Screenshots of the training platform on IPV6 courses

The pedagogical script of this first training is explained in figure 2 [10]:

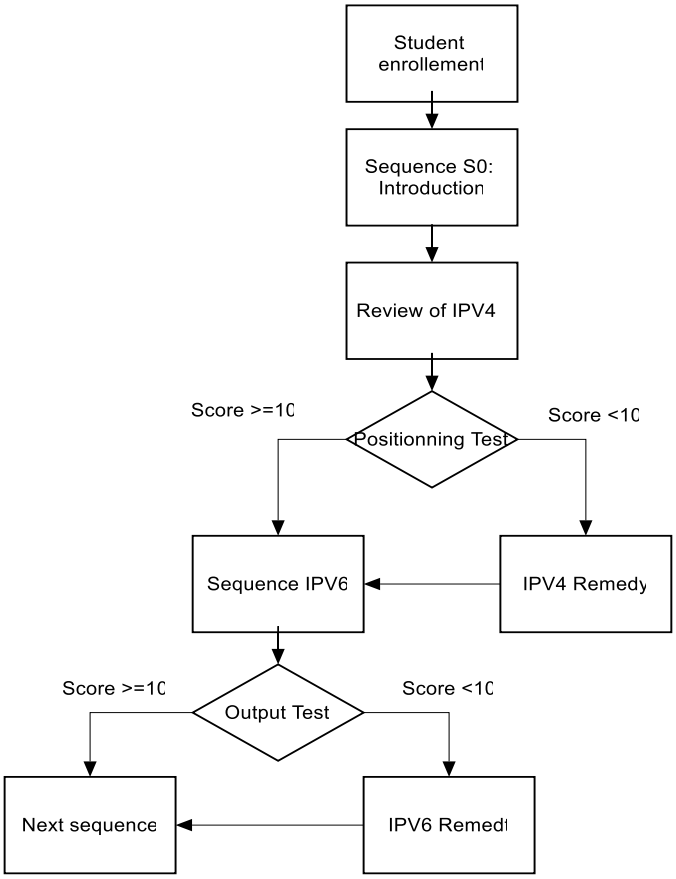

Fig. 2. The application diagram of IPV6 SPOOC

First, we launched the first SPOC experiment "IPv6 fundamentals" over a 4-week period. In a second step, the second experiment on the same SPOC was spread this time over a period of 6 weeks in which we integrated the practical workshops. We noticed that the validation results of the

students' tests in the second experiment were better than those of the first experiment (see figure 3). This is due to the benefit of the practical workshops we introduced in the 2nd experiment, which allowed students to understand better the concepts covered in the course and therefore obtain better results.

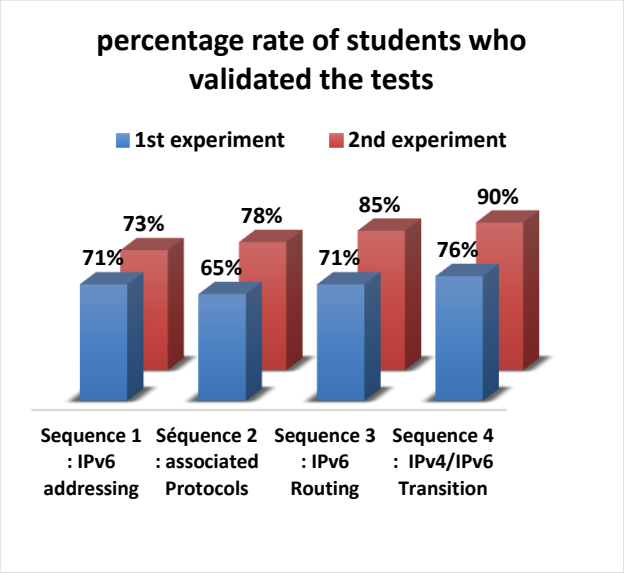

Fig. 3. Comparison of the validation of tests between experiment 1 and experiment 2

Of all the sequences proposed, each participant obtained better results in the exit test and an improvement in his level of knowledge. Indeed, Figure 4 below illustrates this improvement through the results of a participant's input and output tests (score out of 10) compared to all the sequences offered on our "CloudSPOC" platform.

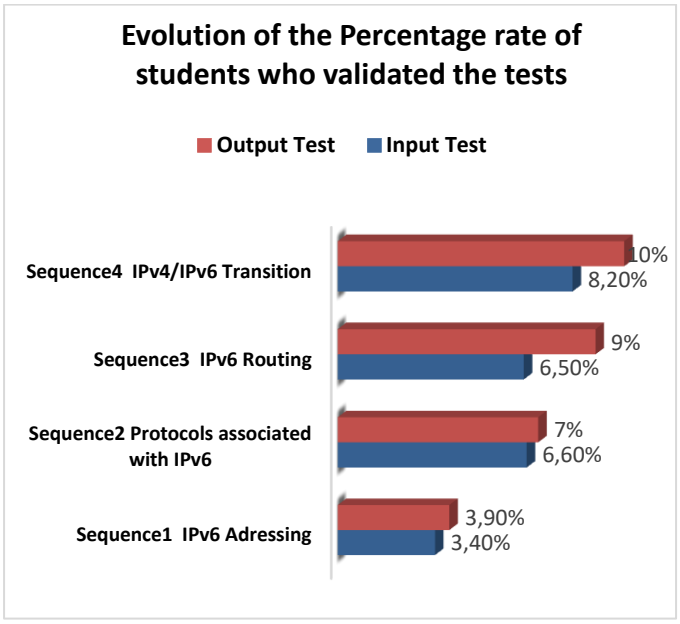

Fig. 4. Evolution of the Percentage rate of students who validated the tests

The second SPOC on practical work on electromagnetism in vacuum

A first experiment of this SPOC was carried out with students in the second year of their bachelor's degree in applied mathematical sciences, who followed the practical work of the module "Electromagnetism in a vacuum". This experiment was carried out with the participation of 53 students called upon to follow the online training concerning the prior preparation of these practical exercises. To be able to evaluate the contribution of our approach, we used questionnaires (Pre-Test and Post-Test) and a summative evaluation through the TP exam in order to verify the evolution of the students' level of knowledge following this self-training. The students perform the Pre-Test at the beginning of the TP session in person and the Post-Test at the end of the session, the organizing chart of the training is presented by figure 5. The objective is to involve students and encourage them to follow the self-training provided online and on the other hand, it will facilitate the subsequent categorization of responses (see Figure 7). The results of the summative evaluation obtained were compared to those of the previous promotion (see Figure 8).

Fig. 5. The entry sequence of the training platform on electromagnetism in vacuum course.

The experiment is motivated by the fact that we took personally in charge the teaching of the practical work of the subject in question and for all groups of the same field. The 53 students concerned were asked to follow up the online training as a support for a preliminary preparation of practical works. The control group considered in this experiment was the SMA promotion of the year 2016.

The organizational chart of the preparatory training for practical work proposed via the CloudSpoc platform is presented by the following figure 6:

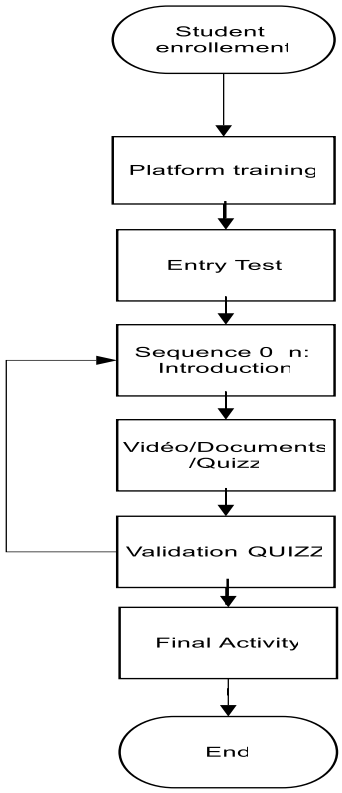

Fig. 6. The application chart of the preparatory training of Electromagnetism in a vacuum

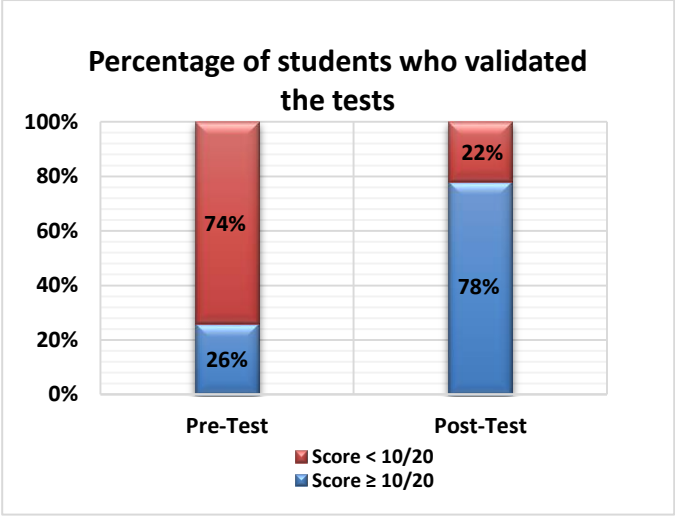

Fig. 7. Comparison of the results of the Pre-Test and Post-Test resulting from the SPOC preparatory test of TPs.

The results of the Pre-Test show, on the one hand, that our

students are not yet used to this type of self-study online learning because our experiment is the first of its kind for them since only 33% of the students have been able to complete the training. The results of the Post-Test show that the improvement in students' level of knowledge appeared after the practical work session in class following the support and follow-up of the supervising teachers.

Concerning the summative evaluation through the practical work examination carried out at the end of the session, we compared the results obtained by the 2017 promotion with those of the previous promotion concerning the same sector. The following figure 8 illustrates the percentage of student enrolment classified into three categories:

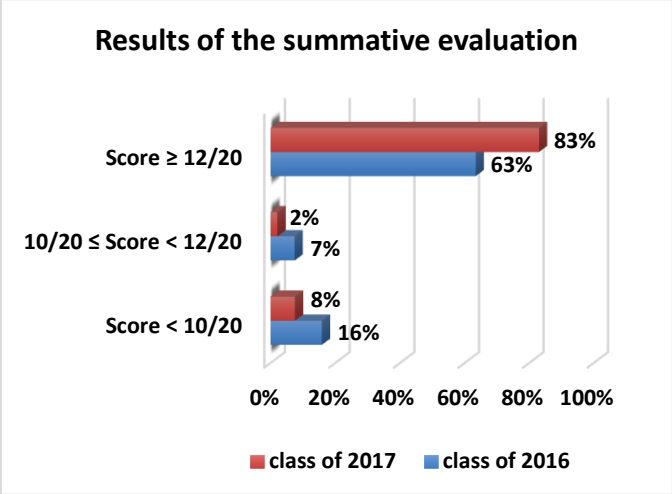

Fig. 8. Comparison of the summative evaluation results between the 2016 and 2017 promotions.

V. RESULTS DISCUSSION

The results of the two primitive experiments of integrating the two forms of MOOC into university teaching were very satisfying. We noted a clear improvement in learners' levels, and an improvement of facility of class management for supervisors. However, we were able to identify a number of problems related to the adoption of these tools in teachers' pedagogical practices. Indeed, these problems affect three main areas, the first concerns the ability of teachers to script, create and publish online content, and more particularly scientific and pedagogical content related to a MOOC. Consequently, universities must plan training courses with practical workshops in order to initiate the coaching of course designers in their achievements. At Chouaib Doukkali University, specialists from AUF (Agence Universitaire de la Francophonie) were summoned upon to schedule such training; the enrolment rate was high, which reflects the interest that is beginning to take hold among teachers to integrate MOOC in their teaching practice. The second area is the need to facilitate access to such platforms, which are published and accessible via the Internet. According to statistics from the university campus, the majority of students access online content from home via a mobile Internet connection. Students often complain about the poor quality of the Internet connection that slows down the loading of videos and interactive media. So universities should consider providing classrooms dedicated to this type of access while providing the necessary audio video devices for this learning. Such a decision is part of the last area relating to the motivation of students to accept and above all to adopt such practices, the programming of the awareness day as well as the need to take these trainings into account in the evaluation of face-to-face courses remain a necessity.

On other hands, adapting existing MOOCs that are not designed to integrate them into traditional classrooms can be a huge challenge. There is no guarantee of student engagement, satisfaction and effective learning. This operation is largely influenced by two elements of coupling and cohesion. In addition to examining the quality of the proposed MOOCs, in terms of knowledge and pedagogical process. Instructors must find the best way to integrate MOOCs into a traditional classroom, motivate students (participants) to enroll in the courses offered and complete the training. There are no rules to apply in a predefined context, but it is essential to understand the main objective of each MOOC proposal, as well as public expectations, in order to find the best scheme to integrate and publish this content.

It is always necessary to supervise students. This monitoring is carried out by a local teacher, who is really involved in the integration of MOOC, because it requires a good knowledge of MOOC (device and content) and a reflection on hybridization of learning practices.

VI. CONCLUSION

This paper proposes to study two examples of integrating MOOC (SPOC) to support face-to-face learning environment. For this purpose, two experiments were conducted at the faculty of science in Chouaib Doukkali University. In the first

experiment the MOOC course was presented as a complement content to a face-to-face training, and targeted specialized master's degree students in" Instrumentation, Networks and Renewable Energies". The second MOOC was presented as a preliminary preparation for the practical work in electromagnetism in vacuum carried out in the classroom for students enrolled in the second year of the Faculty of Science in mathematics field (SMA). In both cases, integrating MOOC in teaching gave satisfaction. In fact, when MOOC is offered using hybrid formats, it can improve student outcomes and reduce costs. However, the courseware need to be modular with an easy content to implement and repurpose, and provide assurance of online content availability for use in the future. Pedagogical engineering makes it possible to deal with the complexity associated with the design and mediatization of courses under technological platforms. In a future work, a MOOC version for both SPOCs with an improved content is currently under development

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