

CloudSPOC: Additional face-to-face courses for an evolving higher education

Khalid EL KHADIRI, Ouidad LABOUIDYA, Najib ELKAMOUN, and Rachid HILAL

STIC Laboratory, Faculty of Sciences, Chouaib Doukkali University, El Jadida, Morocco

Summary

Online training using computer-based tools such as the Massive Open Online Courses (MOOCs) has become an essential learning method for remote training, whether for the individual, the professional or even the student. These courses are free and open to all, which is likely to have a large number of registrants and thereafter it is difficult to follow them on the supervision side by the teaching staff, therefore a small percentage of participants in a MOOC validates their training. On the same model as the MOOCs, the SPOCs (Small Private Online Courses) differ at the targeted public level, they are not open to all but deliberately limited to a reduced number which is easy to follow and coach for more efficiency. In this article, we will develop, experiment and evaluate a SPOC, complement of face-to-face courses, by developing a platform of creation and management of the SPOC called "CloudSPOC". This is a SPOC on the IPv6 protocol, giving interactive scripted content (courses, tutorials, tests, workshops and remedies), intended for students of "Masters" or more and this in order to: 1) Identify learning disabilities for these students 2) Look for ways to improve this SPOC / device through the implementation of new modes and / or learning scenarios.

Key words:

On-line / distance learning, SPOC, Higher education, Experimentation.

1. Introduction

Online training [1] as the name suggests allows to follow a distance training using computer tools such as MOOC, SPOC, ... Whether you are salaried, independent or private, professional or student, it is possible for everyone to learn from home and acquire new knowledge to enrich their CV, develop their general culture or simply to acquire an additional training to boost his professional career. In this article, we will examine the concept of online / distance learning by developing, experimenting and evaluating a SPOC, complement of face-to-face course, for IPv6 protocol intended for students of masters or more. In this work, we carried out two experiments, the first is for the test of the device and the experimentation in the real environment, And the second one whose students followed the "Network Architecture" module divided into 4 face-to-face chapters and a chapter on IPv6 online. The rest of the article is organized as follows: Section 2 will discuss a theoretical context and a comparison between MOOCs and SPOCs, section 3 will present a state of the art of the

research work carried out in this field and our motivation for this research, section 4 will discuss the implementation of our SPOC, section 5 will present the experiments and analysis of the results, and the conclusion of the article and perspectives will be presented in section 6.

2. Theoretical Context

With the discovery of distance learning [2] [3], people become from more and more interested in online training because it breaks the constraints of the face-to-face. The acronym MOOC [4] appeared in 2008 but its success is the most significant event in 2012 in the world of online higher education. Currently, many universities around the world organize free MOOCs on various themes such as cryptography, biology or philosophy.

MOOCs, SPOCs are acronyms that come together and are all part of online training. These are varieties of e-learning or distance learning that promote the autonomy of learning [5] among students.

- MOOCs: are free and open to all, generally limited in time on a specific topic [6]. They include a coherent set of teaching resources, interactions modalities, exercises and examinations leading eventually to certification [7] [8].
- SPOCs: differ in the target audience [9], they are not open to all but voluntarily limited to some thirty participants. Reduced and better tracked for greater efficiency [10].

Table 1 below presents a comparison between MOOCs and SPOCs:

Table 1: Comparison of MOOCs and SPOCs

	MOOCs	SPOCs
Definitions	Open and massive online courses.	Online courses in small groups.
Targeted audience	Open to all.	Limited access (10 to 30 participants).
Objective	Democratize education.	Limit access for more efficiency.
Operation	They are platforms with courses in multimedia (video, audio, MCQ, etc.) accompanied by accompanying resources necessary for the smooth running of the course (eg videos explain how the course works or the detailed instructions needed to carrying out an exercise, etc.).	The learner benefits from a face-to-face (indoor after the courses withdrawn online) by the contribution of practical work in class.
Rate	Free: MOOCs are free and open to all. Certification: MOOCs can be certified, paid or not.	Paid: SPOCs are distinguished by small groups (10 to 30 people) in this the training is not free. Certification: paying.
Diplomatic training	Do not give any certificate or diploma but there are MOOCs platforms that grant certificates to people who go to the end of their journey.	He is a graduate. The SPOCs are necessary to allow a better proximity teacher / student and better coaching of the learners. And most importantly, obtaining a degree at the end.
Accessibility	Accessible via time-limited periods.	They are pedagogical sequences accessible by a small group of students and then reworked with the teachers. Also, limited in time.
Interactivity	In the MOOCs, there are experts but very few intervene in the discussions (case of cMOOCs).	Teachers can orient the face-to-face course by focusing on points not understood or blocking for learners. The course then becomes more "interactive" and is constructed of a true interactivity.
Evolution	According to the different platforms of MOOCs we will find the cMOOCs (MOOCs connectivity) and xMOOCs (transmissivity MOOCs).	Hybrid solution. More suited to the expectations of companies. SPOCs would be the new generation of distance education (Germinet 2014).

3. State of the art and motivation

Initially, universities were attempting to distance education [11], but the emergence of MOOCs in 2008 and their successes in 2012 have, on the one hand, encouraged several universities all over the world to make free courses and on the other hand to do research, experimentation and evaluations on this concept in order to minimize the learning difficulties and maximize the factors of success. The authors Tahiri, Bennani and Khalidi have established a state of the art on the foundations of MOOCs [12], its purpose is to describe these different concepts: Types of MOOCs, scripting courses, participants, evaluation / certification methods / procedures. A short history of the MOOCs was led by author Daniel [13] by defining them in a wider context of the evolution of educational technology and open / distance learning. An overview of the issue of MOOCs was presented by the authors Trestini and Rossini [14] through evocations of French professional actors in online education. The authors Collin and Saffari carried out an analysis from a critical perspective [15], the speeches of

generalist journalistic articles online on the MOOCs. A typology of hybrid training devices was developed by Burton authors, Blakeman, Chan, ... and Leclerc [16] depending on five dimensions the presence/distance articulation, mediatisation, mediation, accompaniment and the degree of openness of the device in order to understand the differentiated effects of hybrid training devices in higher education. An experiment with the MOOC iTYPa was carried out by the authors Carolan and Magnin [17] with the aim of defining the attitude of the student engineers to this training over a period of 10 weeks enabling them to validate the associated credits within their engineering curriculum. Other experiments [18], [19] and [20] were carried out with the aim of, on the one hand, eliminating the links between the instrumental characteristics and the different types of motives of the participants in a MOOC and on the other hand, addressing the challenges and successes of distance education / hybrid.

In addition, MOOCs suffer from an extremely high abundance [21] due to the large number of the enrolled in the absence of supervision and follow-up. Despite the work done on MOOCs in order to improve and increase the rate of participation, motivation and monitoring, experiments

have shown that a small percentage of participants follows and validates their training. This triggered our motivation to develop a SPOC complement of face-to-face courses, limited to a reduced number of people, easy to follow and mentor for more efficiency. The SPOC is therefore an appropriate solution: to allow a better teacher / student proximity as well as a better supervision of the learners. "SPOC would be the next generation of distance learning." (Germinet, 2014)

4. Implementation

To implement our SPOC, we used the following approach:

- Choose a pedagogical scenario to put online the contents (courses, tutorials, tests, workshops and remedies)
- Choose a suitable platform that meets the specifics of the proposed scenario

4.1 Scenario choice

The pedagogical scenario that we chose consists of an introductory sequence followed by 4 sequences in each of them, the learner must go through the following steps:

- Input or positioning test;
- Courses / remedies;
- Tutorials;
- Workshops;
- Output test.

4.2 The application diagram

Access to and / or between sequences is controlled, each participant after connecting to the platform must follow an educational scenario as shown in the diagram in Fig 1 below.

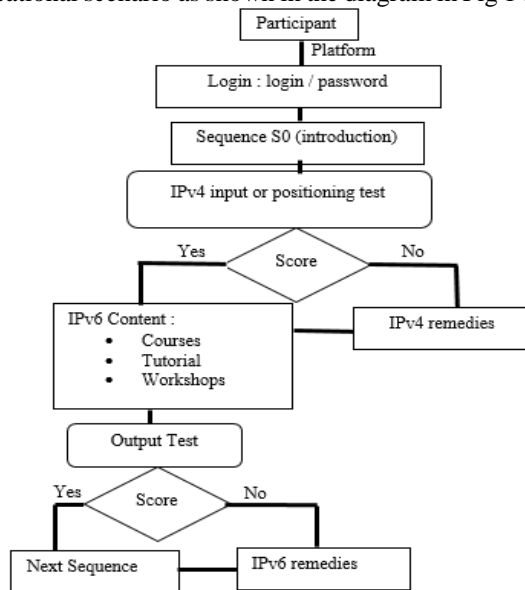


Fig. 1 The application diagram

4.3 Evaluation

Evaluation [22] is an approach that aims to give value, take a step back, make a statement about a situation, and make decisions, with regard to the initial objectives and the aims of the action.

The evaluation [23] is a concept that takes different forms to design the lessons and control the learning. In addition, evaluation is the benchmark that will allow students to locate their learning [24] at the beginning of a training (diagnostic evaluation), to measure their evolution during the lessons (formative evaluation) and finally to check whether they have acquired sufficient knowledge (summative evaluation).

Not all learners have the same prerequisites for a given learning area, and it is important to introduce a form of positioning [25] at the beginning of the training to estimate the learner knowledge level.

- The input or positioning test: is a test in format MCQ whose objective is to verify the pre-requisites of the participant with respect to some notions IPv4 so that it can well assimilate the content of the IPv6 course.
- The output test: is also a test in the MCQ format whose objective is to evaluate the progress of the participant in relation to the content of the consulted IPv6 course.
- Remedies: are used to provide the student with other learning resources / activities to enable the student to fill in the gaps diagnosed in an IPv4 or IPv6 test.

4.4 Choice of the platform

If we manufacture an object and then we want to distribute it, we need a truck to ensure the delivery. With regard to the courses distribution, the platforms represent the distribution channel. (Pecquet, 2013)

Different online learning platforms can be used to bring online content such as Moodle, Claroline, Ganesha, etc. These platforms have not met the needs of our scenario because they do not manage the redirection function to redirect the participant in his / her learning path (continue the course or go to remediation) on the basis of the result of a given test. This constraint has prompted us to develop our own "CloudSPOC" platform for the implementation of our system while responding to our envisaged pedagogical scenario.

"CloudSPOC" is a smart platform for creating and managing on-line SPOCs complements of face-to-face courses. The different online courses filed on the platform as shown in Fig. 2 below are additional face-to-face courses.

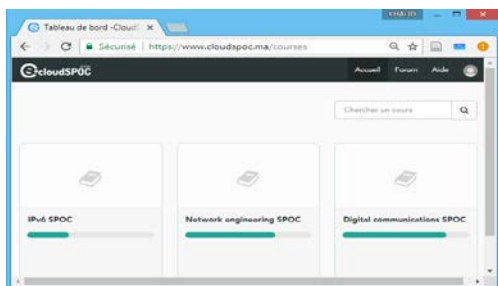


Fig. 2 The CloudSPOC platform

5. Experimentation and results analysis

5.1 First experimentation

This experiment was carried out over 4 weeks, with the participation of 17 students, from a Master in "Telecommunications Networks and Industrial Electronics" and who have joined the doctoral cycle. The objective of this first experiment is to test our CloudSPOC platform through, on the one hand, the assessment of the students' achievements by the device with respect to various online contents (lectures, tutorials, input / output tests, workshops and remedies work) in order to identify learning difficulties in their homes, and on the other hand to verify the impact of remedies on learning and the improvement of the learners' knowledge level.

The results of this experiment are subdivided into two categories:

- Assessment results of students' learning by the device, from the point of view assimilation of the various contents put online in order to identify learning difficulties in them.
- Remediation impact results on learning and improvement of learners' knowledge level.

Assessment results of student achievement by the system

In all the sequences, the results of the participants were excellent. Fig. 3 below shows a relative example of sequence 1 "IPv6 addressing".

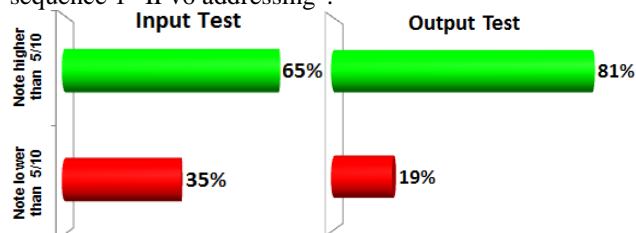


Fig. 3 Results of participants related to sequence 1 "IPv6 addressing"

According to Fig. 3, it is noted that the results of the output test are better than those of the input test, which explains

why the output level of the participants has been improved compared to that of the entry sequence. If a test is not validated (the results with the red color), the participant is redirected automatically, according to the educational scenario envisaged, to the remedies.

On the set of all the proposed sequences, each participant obtained better results during the output test and an improvement in his level of knowledge. Indeed, Fig. 4 below illustrates this improvement through the results of the input and output tests (score of 10) of a participant with respect to all the sequences proposed on our "CloudSPOC" platform.

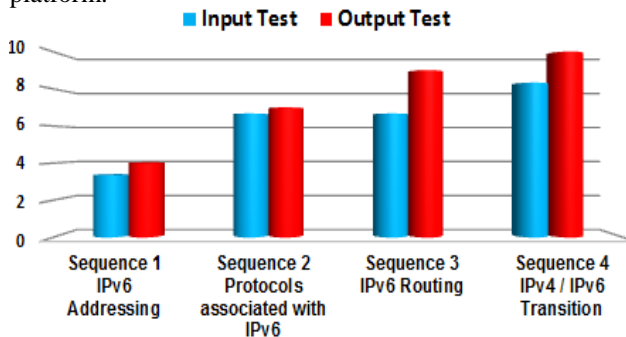


Fig. 4 Results of a participant for all proposed sequences

Remediation impact results on learning and on improving learners' knowledge level

Remedies allow a student to fill in the gaps diagnosed in an IPv4 or IPv6 test by providing other learning resources / activities. For the sequences where the participants have not been able to validate the tests, remedies must take place.

Let's take the example of sequence 1 "IPv6 addressing" Fig 3: 81% of the participants obtained more than the average (score of 10) whereas 19% could not validate the tests and are supposed to go through step of remedies. 67% of the respondents actually appealed for remedial measures and were able to improve their knowledge level. Unlike this, 33% of the remaining students did not go through the remediation stage (optional remediation until then) when they had to do so. As a result, their level of knowledge has not been improved, which has prompted reflection on the need to make these remedies mandatory. Indeed, we noticed a marked improvement in the participants who used the remedies proposed through the best results as they progress in the course sequences. This shows that remediation has added value and a positive effect on learning.

At the end of this first experiment, the results of the students were better and their knowledge level was greatly improved compared to that of entry in relation to each of the proposed sequences. In addition, and thanks to the remedies proposed by our learning scenario to the participants in the form of resources / learning activities to enable them to fill the gaps diagnosed during an IPv4 or IPv6 test, we found that this

approach has improved their level of knowledge and helped them excel in the rest of the course and achieve better results. Furthermore, we did not use the practical workshops because the time spent on the experimentation was not sufficient. This prompted us to launch a second experiment using practical workshops over a longer period than that of the first experiment, in order to compare the evolution of the students' level of knowledge with the first Time experimentation, and the addition of practical workshops to measure learning disabilities at home and, on the other hand, to measure their degree of satisfaction with our SPOC / device.

5.2 Second experimentation

This experiment involved 41 students, who graduated from a bachelor's degree and who have integrated the core curriculum of the specialized master's program "Instrumentation, Networks and Renewable Energies" over a period of 6 weeks.

The aim of this experiment is to compare the evolution of the students' level of knowledge with respect to the first experiment in relation to the time allotted to the experiment (passage of 4 to 6 weeks), and in function of inclusion of additional practical workshops in order to measure learning disabilities, and, on the other hand, to measure their degree of satisfaction with our SPOC / device.

The results of this experiment are subdivided into three categories:

- The evolution results of the students' knowledge level compared to the first experimentation according to the time allocated to it and according to the workshops addition in order to measure the students' learning difficulties
- Results of learning difficulties using student feedback in relation to the content posted on our device
- Results of participants' satisfaction in our SPOC / Device. These will help to identify areas for improvement.

Results of the evolution of the level of knowledge of the students compared to the first experimentation

In all the sequences, by comparing the output level with that of the input, the results of the output, the level of knowledge of the participants have been improved (Fig. 6 below) compared to the first Experimentation (Fig. 5 below). This is due to the time allotted to the experiment (passage of 4 to 6 weeks) which allowed the participants to take full advantage of the time to make all the proposed sequences while improving their level of knowledge.

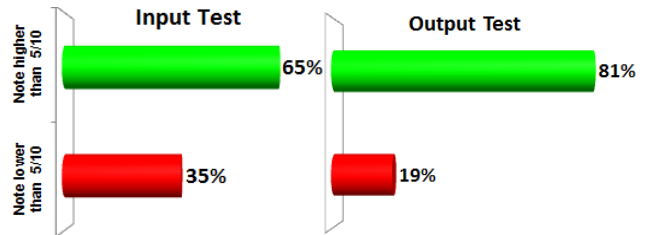


Fig. 5 Results of the participants relating to the sequence 1 "IPv6 addressing" First experimentation

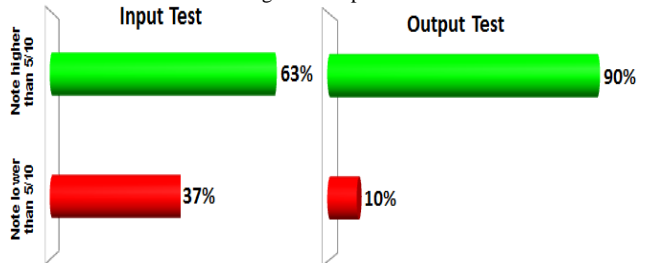


Fig. 6 Results of the participants relating to the sequence 1 "IPv6 addressing" Second experiment

Similarly, in this second experiment, participants who could not validate the tests (results with the red color) are supposed to go through the remediation step. 75% of the respondents actually appealed for the remedial measures proposed and were able to improve their level of knowledge. Unlike this, 25% of the remaining students did not go through the remediation stage (optional remediation) when they had to do so. As a result, their level of knowledge has not been improved, which has prompted reflection on the need to make these mandatory remedies. Indeed, we have also noticed a marked improvement in the participants who have used the remedies proposed by obtaining better results as they progress in the sequences of the course. This shows that remediation has added value and a positive effect on learning.

Moreover, the addition of practical workshops in this second experiment allowed the participants to fully understand the concepts dealt with in the course and consequently this has contributed to the improvement of the learning at home.

Thus, we have observed that the results of this experiment, even if they are satisfactory, do not give explicit and transparent information on the learning difficulties of the participants. For this purpose, we used the systemic evaluation approach of our SPOC by the participants, inviting them at the end of the experiment to answer an anonymous online questionnaire on our CloudSPOC platform, consisting of four parts:

- Part 1: Organizational. In this chapter, we interviewed the students in terms of the percentage of SPOC tracking, the time period and the SPOC tracking location.
- Part 2: Pedagogy. In this chapter, we interviewed students on diverse parts of the SPOC, the course,

tutorials, workshops, input / output tests, and remediation.

- Part 3: Technique. This chapter was evaluated in terms of frequency of use of the platform, interactivity and exchanges between students, the availability of supervisors and in terms of consultation and participation in the forum. Participants were also asked about platform availability, accessibility, ease of use, compatibility with existing browsers, server-side performance, or hosted platform and to the use tutorial of the platform.
- Part 4: Satisfaction / Proposal. In this chapter, we asked participants about their satisfactions, assessments and proposals to improve our SPOC / device.

The aim of this questionnaire is to identify students' learning difficulties by analyzing their feedbacks in relation to the different contents put on line (courses, tutorials, input / output tests, workshops and remedies) And on the other hand to measure their degrees of satisfaction with our SPOC / device.

Results of learning difficulties using student feedback in relation to the content posted on our device

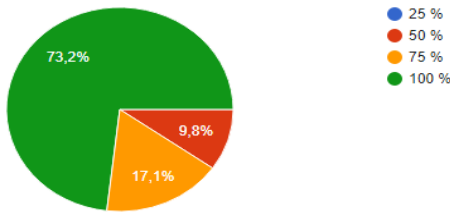


Fig. 7 SPOC follow-up percentage

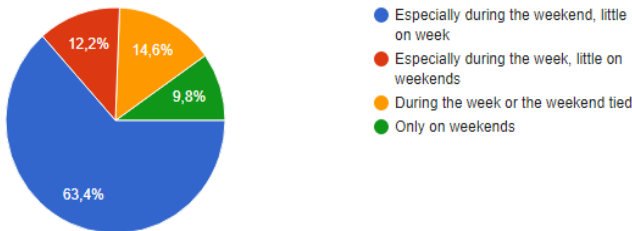


Fig. 8 SPOC follow-up period

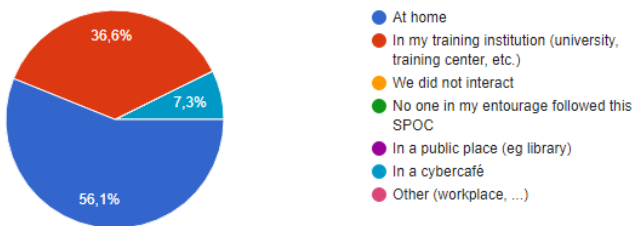


Fig. 9 SPOC follow-up location

Figure 7 shows that a significant number of students followed SPOC, about 73.2% of students completed SPOC, 17.1% followed 75%, and 9.8% followed only 50% of the SPOC. Students who did not complete SPOC had problems on the one hand, finding the time to do so as shown in Fig. 8 above where about 63.4% of students follow the SPOC during the weekend, on weekdays because during the week they follow other modules of their training in face-to-face, and on the other hand the problem of Internet connection, because there are some students who do not have Internet connection at home, they follow the SPOC just through the Internet connection of the university and on cybercafés as shown in Fig 9 above, where there are about 36,6% following the SPOC using the Internet connection from the university and 7.3% on cybercafés.

For the "Course" part, which is shown in Table 2 below, we found very encouraging results, more than 93% of participants strongly agreed or somewhat agreed on all the parameters compared with less than 7% who disagree strongly or disagree. This explains why the objectives of the course and the explanations provided were very clear, and the examples were very varied and appropriate, allowing participants to take full advantage of the course content.

Table 2: Results in % combined on the "Course"

Course	STATEMENT	COMBINED RESULTS IN %	
		Not agree at all + Little agreement	Totally agree + Somewhat agree
1)	The plan and objectives of this course are clearly defined at the beginning	7	93
2)	The explanations are clearly	5	95
3)	Examples are varied and appropriate	5	95

Table 3: Combined results in % for "Tutorial"

Tutorials	STATEMENT	COMBINED RESULTS IN %	
		Not agree at all + Little agreement	Totally agree + Somewhat agree
1)	The coordination between the course and the tutorials is well done	7	93
2)	The Tutorials were sufficient for understanding the concepts	27	73
3)	Solutions were clear	7	93

For the "Tutorial" part, which can be seen in Table 3 above, we found encouraging results, over 73% of participants strongly agreed or somewhat agreed of all evaluation parameters, compared with less than 27% who disagree or strongly disagree, which explains why the coordination

between the tutorials and the course was well done, the clarity of their solutions and their sufficiency to complete the course as well.

For the "workshops" section, which is shown in Table 4 below, we found very encouraging results, more than 80% of participants strongly agreed or somewhat agreed on all the parameters. Less than 20% who strongly disagree or disagree, which explains why the objectives of the workshops were very clear, their coordination with the course was well. The configuration tutorial was sufficient. It this enabled the participants to make and configure the workshops easily.

Table 4 : Combined results in % for "Workshops"

	STATEMENT	COMBINED RESULTS IN %	
		Not agree at all + Little agreement	Totally agree + Somewhat agree
Workshops	1) The objectives of the workshops are well defined at the start	2	98
	2) The coordination between the course and the workshops is well done	10	90
	3) The concepts treated go beyond the course	15	85
	4) The workshops were sufficient to understand the course concepts	20	80
	5) For the configuration of the workshops the tutorials proposed were sufficient	12	88

Table 5 : Combined results in % for "Input / output tests"

	STATEMENT	COMBINED RESULTS IN %	
		Not agree at all + Little agreement	Totally agree + Somewhat agree
Input / output tests	1) The objectives of the tests are well defined at the start	5	95
	2) The coordination between the course and the tests is well done	10	90
	3) The concepts treated go beyond the course	7	93
	4) These tests allowed you to self-assess	15	85
	5) These tests allowed you to better understand the succession of sequences	2	98
	6) These tests have allowed you to progress better in your learning	5	95
	7) The possibility of repeating a test (2 attempts / test) had added value for your learning	15	85

For the "Input / output tests" section, which can be seen in Table 5 above, we found very encouraging results, more than 85% of participants strongly agreed or somewhat agree

on all the evaluation parameters compared to less than 15% who disagree or strongly disagree. This explains why the objectives of the tests were very clear, their coordination with the course was well done, and the possibility of repeating a test has a positive effect and an added value on learning.

Table 6 : Combined results in % for "Remedies"

	STATEMENT	COMBINED RESULTS IN %	
		Not agree at all + Little agreement	Totally agree + Somewhat agree
Remedies	1) The remedies proposed met your expectations	7	93
	2) These remedies had added value for your learning	0	100
	3) If a test / sequence is not successful, these remediations should be mandatory to move to the next sequence for better learning	10	90

For the "remedies" part, which is shown in Table 6 above, we found very encouraging results, over 90% of participants strongly agreed or somewhat agreed on all the parameters. Less than 10% who disagree strongly or disagree. On the one hand, the students found that the remedies met their expectations and added value to their learning, and on the other hand a significant percentage of 63.4% of the students wanted remedies to become compulsory for better which can be seen in Fig. 10 below.

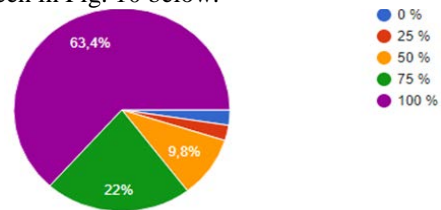


Fig. 10 Percentage for requiring remediation

Results of Satisfaction of SPOC Participants / Device

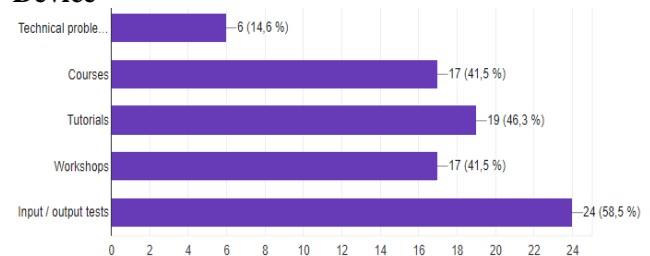


Fig. 11 Frequency of use per day of the CloudSPOC platform

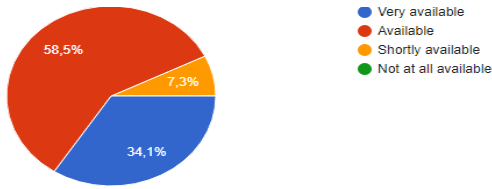


Fig. 12 Interactivity and exchanges between students of the CloudSPOC platform

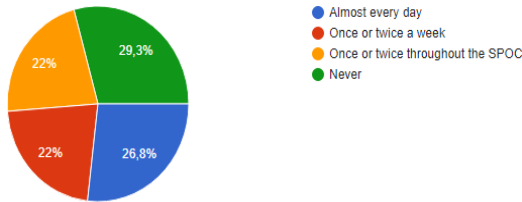


Fig. 13 Availability of CloudSPOC platform supervisors

According to Figure 13, we observed that the supervisors of our CloudSPOC platform were available during the period of experimentation in order to answer the participants' questions. In addition, our platform is interactive based on its frequency of use (Fig 11) and student exchanges (Fig 12).

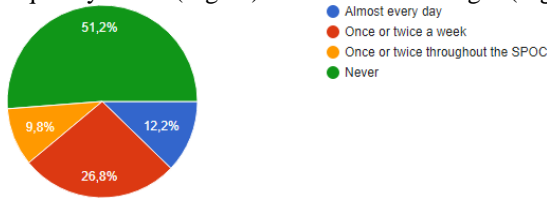


Fig. 14 Forum consultation percent

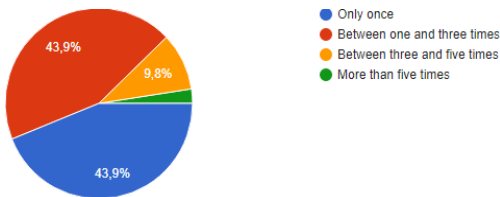


Fig. 15 Percentage of participation in the forum

According to Fig. 14, a significant percentage of the students consults the forum in different periods compared to 29.3% who have never consulted it. However, participation remains fairly low according to Fig.15, about 51.2% who have never participated. This can be explained either by lack of time, absence of problems or refusal of exchange with the other students.

For the "Platform" part, which is shown in Table 7 below, we found very encouraging results, more than 85% of participants strongly agreed or somewhat agreed on all the parameters. Less than 15% who strongly disagree or disagree. This explains why our platform is always available, accessible, easy to use, compatible with existing

browsers, has a good design and the tutorial on how to use the platform is sufficient. All this allowed the participants to follow the SPOC and take full advantage of the course.

Table 7: Combined results in % for "Platform"

STATEMENT	RESULTATS COMBINES EN %	
	Not agree at all + Little agreement	Totally agree + Somewhat agree
1) In terms of availability, the platform is always available	10	90
2) In terms of accessibility, the platform is always accessible	7	93
3) In terms of ease of use and navigation, the platform is easy to use	12	88
4) In terms of ergonomics, the platform has a good design and a good presentation	7	93
5) In terms of compatibility on the browser side, the platform is multi-browser	15	85
6) In terms of performance, the response time of the server or the hosted platform is optimal	10	90
7) In terms of help tools, the platform has a sufficient tutorial on how to use it	12	88

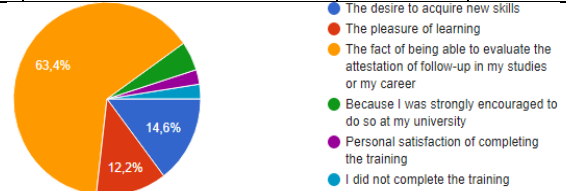


Fig. 16 Some motivation parameters that allowed the participants to go all the way through the SPOC



Fig. 17 Achieved objectives of participants

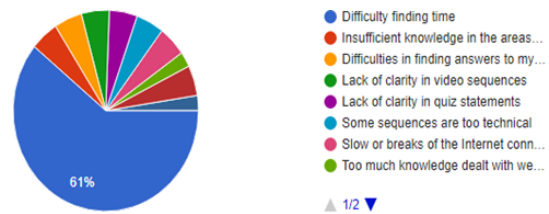


Fig. 18 Difficulties encountered by SPOC participants

According to Fig. 16, it is noted that the desire to acquire new skills, the pleasure of learning and the possibility of obtaining a certificate with a percentage of 63.4% are parameters that allowed participants to go to the end in the SPOC.

In addition, according to Fig. 17, about 70.7% of students achieved the targets precisely, 14.6% exceeded them, but about 61% did not find time to do so the SPOC as it should be, which can be seen in Fig. 18. This can be explained by the fact that they were following other modules of their master's training.

We also asked participants to indicate their positive and negative assessments of the SPOC and proposals to improve our SPOC / device. Here are a few:

Positive appraisals

- The sequence of the course is good
- The choice and clarity of the topics
- The quality of educational content
- Ease of understanding through the use of simple words
- Audiovisual quality (graphics, video editing)
- The availability of SPOC coaches
- The richness of the exchanges between the participants on the forum
- The quality of the exchanges with the pedagogical team on the forum
- The simplicity of the interface
- The ergonomics of the platform

Negative appraisals

- Time is not enough (6 weeks)
- Difficulty to doing all the workshops
- Some concepts are not deepened

Proposals to improve our SPOC / device

- Add more time for the SPOC
- Subtitling videos in Arabic
- Making MCQs in Arabic
- Conduct weekly web conferences with stakeholders

At the end of this second experiment, the level of knowledge of the students was greatly improved compared to the first experiment and this is due to the time allotted to this experimentation (passage of 4 to 6 weeks) and the addition of practical workshops. Thus, the results of participants' feedback on all the parts of the questionnaire showed that the participants followed the SPOC without any difficulties thanks to the good sequence, the clarity of the course, the coordination between tutorials, workshops, tests, and the added value of remedial learning and the improvement of their knowledge level. This is due to the availability of SPOC coaches, interactivity and exchanges between participants via the forum, ergonomics, ease of use and navigation of our platform, which allowed participants

to go further to the end in the SPOC. However, the participants claimed that the time spent on this experiment was not enough to do all the workshops and this can be explained by the fact that they were following other modules of their master's training.

6. Conclusion and perspectives

In this article, we present the results of the development, experimentation and evaluation of a SPOC complement of face-to-face course, for the IPv6 protocol intended for students of masters or more, by developing a platform of creation and management of the SPOC called "CloudSPOC". At the end of the first experiment, which was carried out over a period of 4 weeks, the participants' knowledge level was improved considerably compared to that of entry, in relation to each of the proposed sequences. In addition, and thanks to the proposed pedagogical scenario, we have introduced the redirection function to reorient the participant in his / her learning path (continue the course or go to remediation). Indeed, we have called for remedial actions to provide the learner with other learning resources / activities to enable him / her to fill in the gaps diagnosed in an IPv4 or IPv6 test. We found that this approach has improved participants' knowledge level and, as a result, has helped them to excel at the end of the course and to achieve better results. Moreover, practical workshops were not used because the time spent on the experiment was not sufficient, which was taken into account in the second experiment and thus contributed to the improvement of learning.

At the end of the second experiment, which was carried out over a period of 6 weeks, the level of knowledge of the students was greatly improved compared to the first experiment and this is due to the time allotted to this experiment (passage of 4 to 6 weeks) and the addition of the practical workshops. Moreover, participants followed the SPOC without any difficulties thanks to the good sequence, the clarity of the course, the coordination between the tutorials, the workshops and the tests, the added value of remedial learning and the improvement of their knowledge level. As a result, the availability of SPOC coaches, interactivity and exchanges between participants via the forum, ergonomics, ease of use and navigation of our platform allowed participants to go all the way in the SPOC. Finally, the participants were satisfied with our SPOC / device. In order to improve our SPOC / device taking into account the demands and the appreciations of the participants we will extend this experimentation in order to generalize it, to experiment it and to evaluate it throughout Chouaib Doukkali University over periods wider than those of the first and second experiments.

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Khalid EL KHADIRI: received the Master degrees, Network and telecommunication, from Faculty of sciences El Jadida in 2014. Professor of secondary education qualifying in public education, Actually a Ph.D Student on STIC Laboratory on Faculty Of sciences El Jadida, Network and Telecommunications team. His research interest are: IPv6, NGN, MPLS, Mobile learning, QoS of networks, wireless networks, networks and telecommunications.



education.

Ouidad LABOUIDYA: has a Ph.D. in Information, Technologies and Communication. She is now Assistant Professor at the Faculty of Sciences, UCD El Jadida - Morocco. She is responsible for the research team "TICEF" in ICT laboratory and member of the ADMEE-Europe. Her research focuses on evaluation in higher education, self-training and ICT for



Najib ELKAMOUN: Ph.D, professor higher education degree at Faculty of sciences El Jadida.in the dept. of physics. Researcher member on STIC laboratory, header of Network and Telecommunications team. His research interest includes, NGN, MPLS, Networks, QoS on mobile networks, wireless networks, networks and telecommunications.



Rachid Hilal: Ph.D, professor higher education degree at Chouaib Doukkali University. Actually a vice president of the Chouaib Doukkali University. Researcher member on STIC laboratory. His research interest includes, Hyperfrequency, amplifiers Antennas, Wireless Communications, networks and telecommunications.