The institutional decisions to support remote learning and teaching during the COVID-19 pandemic

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Abstract—**COVID-19 disease caused an out-breaking with implications in citizens' private and public life. Face-to-face higher education had to adapt their lectures abruptly to a remote emergency mode. In this situation, both methodological and technological decisions had a principal role in closing the 2019-2020 academic course successfully. In this paper, the strategic decisions of the University of Salamanca (Spain) at the institutional level are summarized, taking into account not only the principal goal of ending a contingency situation but focusing on how to face the 2020-2021 academic course, in which one all the universities know that they will have to operate with the disease, but the uncertainty will be still present.**

Keywords—COVID-19, technological ecosystem, good practices

I. INTRODUCTION

Higher education faces an enormous challenge due to the collateral effects of the spread of COVID-19 disease worldwide[1]. During the first wave of the SARS-CoV-2 coronavirus in March 2020, the governments imposed various restrictions to control the infection. In almost all countries, restrictions resulted in the closure of the educational centers [2, 3], including university campuses [4-6]. The adopted decisions had implications in all the university missions and functions, stopping most of them and focusing on learning and teaching processes to finish the academic course trying to minimize the harmful consequences for students. Most of the teachers adopted an emergency remote teaching approach [7, 8] that means streaming the class-sessions and the usage of the technology to replicate the lectures rather than making a planned online learning, which is training activities conceived and built with virtual delivery from the outset, using suitable course design and deeply integrated student support, and delivered by faculty with meaningful training in online pedagogy [9]. This emergency approach found its most significant barrier in the assessment, becoming the perfect storm of the educational process [10].

Currently, the academic 2019-2020 is over, but the universities have to face the new academic course with the uncertainty of the second wave of the disease growing day by day. Improvisation and urgency are no longer an excuse [11]. Thus, the universities that faced the emergency with some strategy or institutional decision-making procedures ended the course in a controlled way [12]. More critical, sowed the seeds for the near future in the new starting course and, with an optimistic approach, to take advantage of the acceleration changes in the digital transformation of the universities [13] in a medium-term after the pandemic ends.

Although it is possible to say that the University of Salamanca achieved its principal academic goals as an institution in a successful way within the pandemic restrictions, it is essential having a critical approach [14]. This means learning from the good practices but also from the mistakes done to define more robust and flexible teaching and learning framework that brings about changes to improve as a university that evolves and renews its model to take the advantages of the most advances learning technologies without giving up its face-to-face nature and opportunities under a well-defined teaching methodological umbrella [15].

This paper summarizes the most significant decisions made from an institutional perspective to face the educational processes during the COVID-19 pandemic at the University of Salamanca to learn from the mistakes made and share the lessons learned and the identified good practices.

II. INSTITUTIONAL PILLARS

Most of the faculty have changed to remote emergency education in COVID-19 times [16]. From an institutional point of view, no university had a strategy to face a situation like this before the pandemic. All universities built up their responses under decision-making processes more or less formal or aligned to an incipient strategy at best.

The University of Salamanca tried to make decisions within an institutional plan. Nevertheless, being aware of the adverse situation that all the members of the university (students, faculty, and service staff) were experiencing, the uncertainty in the evolution of the pandemic, and the changes

in the political decisions outside the institution.

In this context, three institutional performance pillars defined all the actions during the most challenging months and were the seeds to start the new academic course.

A. Strategically defined and implemented technological reinforcements

Fortunately, before the pandemic, the University had renewed the physical infrastructure with a scalable set of servers and increased its hard-disk (9TB of dedicated but scalable storage) and network traffic capacity.

The institutional technological ecosystem had a well-design of interoperable software components [17]. However, it presented some drawbacks identified by the technical staff. A schedule to migrate to new versions and integrate new components had been established to go to production during the 2020 summer and be ready at the beginning of the 2020-2021 academic course.

The pandemic broke the entire established plan, with the aggravating factor that the effort had to be made to strengthen the system in operation because there was no option to update it to more modern versions and it had to meet a demand multiplied by a factor of between 3 and 5 (depending on the service) compared with historical data from the same period of the year. Figure 1 shows the institutional virtual campus traffic from March to June, comparing the same period in 2019 and 2020. In the period under consideration, while 12.3 million pages were served in 2019, 34.6 million pages were served in 2020.
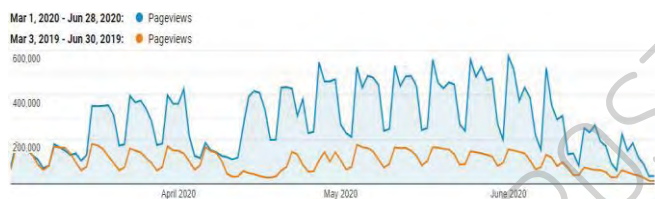

Fig. 1. Institutional virtual campus traffic load from 2020 March to June compared with the same period in 2019

The most outstanding tackled issues related to the technological ecosystem were:

- Moodle version. The institutional virtual campus, so-called Studium, is based on Moodle. The current version when the pandemic started was 3.1.5+. An alternative virtual campus instance based on a 3.8 version was developed to have a complimentary space if the official one was overwhelmed for the online assessment.

- Videoconference services. The official videoconference tool for teaching at the university is Blackboard Collaborate Ultra that is integrated into Moodle. In a face-to-face university, the use of this functionality was a compliment, for example, the average of videoconferences launched in Blackboard during the first ten days of March 2020 was 16.6, the average of launched sessions during the last fifteen days of March 2020 was 590. To reinforce the videoconference services from the institutional perspective, Google Meet and MS Teams were also supported within the institutional ecosystem.

- Virtual campus bottlenecks. With the increase of access to the virtual campus, some bottlenecks appeared in specific moments due to many concurrent entries or service requests. The main stumbling block was that being stuck in an outdated infrastructure. For this reason, only adding more physical devices and updating the configuration of the logical services were possible, with a special mention to:

  1. Assign more disk space to the virtual campus to prevent a storage overflow due to increased system use.

  2. Add a new front-end, going from 3 to 4, and pass them to the most modern hardware we had.

  3. Adjust the configuration of the front-ends to be able to execute the maximum of possible processes.

  4. Configure all possible Moodle caches in memcache.

  5. Review Moodle's scheduled tasks to avoid coinciding with peak hours of use. With the increase in activity, some of them became very time and resources consuming.

  6. Install pgbouncer to pool the database connections. It was the most significant contribution to guarantee the service of the virtual campus without important incidences.

  7. Set up a database mirror to speed up recovery in case of the primary machine failure.

- Online assessment. Once the decision to assess with non-face-to-face methods [18-20], one of the most challenging procedures was to organize the workflow to allow that around 30,000 students could make their exams throughout the virtual campus, taking into account the possible system overflow with many students solving the examinations concurrently plus the rest of the community uses the system for other activities. To solve this situation, a workflow was setup:

  1. The faculty requested an examination in the virtual campus, expressing the subject, the expected maximum number of students, the estimated duration, and the preferred day and timetable.

  2. Taking into account the estimated maximum number of concurrent students taking exams in the virtual campus (after previous load proofs made), an analysis tool was developed to assign a scheduled for each exam (no one should move to another day, and the time-window was usually respected with a difference of one-two hours maximum).

  3. The final assignment was communicated to the teachers by email.

4. A tool was developed inside Moodle to monitor if the faculty fulfilled the mandatory commitment of organizing their exams in the assigned schedule.

5. An alternative action plan was defined to re-schedule those examinations that could have technical problems, and some students could not finish the exam due to the technical issues.

Facing the 2020-2021 academic course and with the lessons learned, a new version of Studium (https://studium.usal.es/) based on Moodle 3.9 has been launched at the end of August 2020, running over an infrastructure of new servers and a solid-state drive disk storage service [21]. We have moved from a single database server to a two main/secondary server configuration. Also, a cache server has been added to improve system response. Figure 2 shows the architecture of Studium institutional virtual campus when the confinement for the pandemic started at March 2020, but Figure 3 presents the new Studium architecture at August 2020.
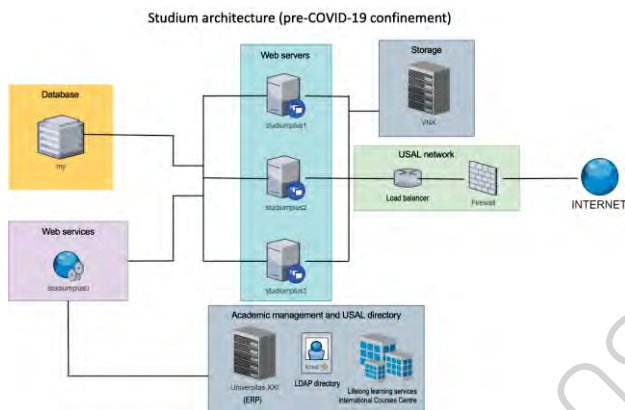

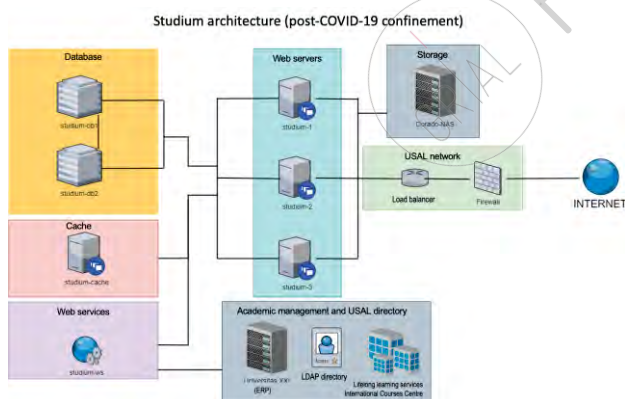Fig. 2.   Studium architecture (pre-COVID-19 confinement)

Fig. 3.   New studium architecture (post-COVID-19 confinement)

B. Information, communication and training

The University of Salamanca provided a simple webpage where information was available to the academic community about education in times of COVID-19. This single page evolved into a portal devoted to online assessment, which currently has become into the institutional website for the community members' training, including faculty, students and service staff, and educational innovation (https://formacioneinnovacion.usal.es/).

Coordinating the communication channels with the academic community is one of the lessons learned. During confinement, there was a discoordination in this area. The messages arrived duplicate and even with ambiguous or contradictory contents. For this reason, a communication policy is required to take the advantages of digital channels, so powerful as social networks, but without overwhelming the recipients, who may ignore or underestimate institutional communications.

Finally, the training for the academic community members has changed with the pandemic [22]. First, it was more faculty-oriented and usually deployed into a face-to-face mode. With the pandemic, the need to cover all the different university roles in a non-face-to-face approach introduced a significant way of developing webinars. Short and specific training actions that hundreds of persons were able to follow in online media and always available for visualization because all of them were recorded.

The acceptance of webinars for the faculty and students was very high. For this reason, to respond to the growing demand for training, the current policy is to combine both webinars and SPOC (Small Private Online Courses). These SPOCs are based on NOOC (Nano Open Online Courses) that will always be available online for a self-paced consumer [23].

Divulgation of the experiences and lessons learned during COVID-19 times was a crucial activity, both in Spain and in other countries, especially in Latin America. In this sense, the Spanish project *Facultad Cero* is one of the most outstanding references, and the University of Salamanca is one of the supporter institutions with its own space (https://facultadcero.org/category/universidades/salamanca/).

C. Collaboration with other institutions

The University of Salamanca is actively involved in networks both at the national and international levels. The interchange of ideas, solutions, proposals, actions, etc. was crucial for advancing in the most complicated days.

We want to underline the collaboration with the Coimbra Group Universities partners at an international level and with the Group of Virtual Education Delegates of the Public Castilla y León Universities at the national level. The latest collaboration effort was very fruitful in many aspects. However, we would like to emphasize the recommendation guide for online assessment within higher education scope [24], one of the references for other official documents by the Ministry of Universities in Spain and other countries [25].

III. CONCLUSIONS

The COVID-19 has led to an unprecedented scenario in the higher university missions and activity area, with a special emphasis in teaching and learning mission. In the first attempt, most of the universities worldwide pivoted to remote emergency teaching and learning. However, the most complex situation was to assess in the only way ensuring a fair process for everyone.

There were mistakes and lessons learned on the road to achieving the principal objective: suitably finishing the 2019-2020 academic course, preventing students from losing their future opportunities [26]. Nevertheless, the new academic course starts, and unfortunately, the COVID-19 disease has not been defeated. We face this situation with uncertainty, but

we hope to be more prepared to develop our missions as University much better.

Moreover, we have the opportunity to renew the models of our universities, taking into account the severe disruption COVID-19 is causing. However, we need reflection to find innovative, creative, and novel approaches for education and research for a well-defined change in the mid-term.

The near future also requires actions in more missions than teaching and learning. Mobility, research, management, social responsibility, equity, inclusion, etc. are in the universities' core. These areas are requesting attention too to be part of the university unstoppable digital transformation. This digital transformation should be part of a strategic plan that outlines and defines the critical processes required for establishing new educational and operational models that guide the orientation and value proposition. A higher education institution should have a comprehensive plan with viable initiatives focused on people and empowered by technology. Besides, the use of technology is the medium for introducing improvements and needed change. The University digital transformation means embracing the digital society in which we live, creating a more transparent place, which promotes equality, inclusion, participation, and social implication.

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