BIG ACADEMIC OPEN COURSE BASE ON CLOUD COMPUTING

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Abstract

BAOC is a proposal based on the MOOC modality for school courses. Approximately 90% of the course activities are carried out online, as in the case of MOOCs, this allows the course to have a greater coverage and the number of students attended increases. In contrast to the MOOC, in our model the course takes place in an academic context, where a grade must be assigned to the student at a pre-established time. For this reason, it includes face-to-face activities to validate that the student acquired the knowledge and skills raised in the course objectives. Our model is not as flexible as the MOOC, it integrates accompaniment mechanisms that favour motivation and follow-up on the progress or lag of the student.

The technological architecture used for the implementation of the BAOC integrates a virtualized server set: Application Server (here reside the available applications as services), a Web Server as the basis of the Virtual Learning Environment (Sakai) and a Database Server (which manages the structured information). It also includes a Video Streaming System for online session support in real time and a File Server (to share documents).

BAOC was applied during 3 years in the course of Numerical Methods in Engineering, in the Division of Basic Sciences and Engineering of the Metropolitan Autonomous University, with 1165 students participated. It was observed that the retention index oscillated between 68% and 74% and was decreasing up to 46%, however, in comparison with a MOOC course they are acceptable percentages. While for the approval index, it is observed that in autumn trimester it oscillates between 54% and 65%, and in the spring trimester the percentage of approval increases up to 77%.

Keywords: MOOC, BAOC, b-learning, cloud computing.

1 INTRODUCTION

The human and physical resources of the Higher Education Institutions (HEIs) are not sufficient to meet the demand [1], [2], [3]. The use of virtual learning environments is an alternative that can give attention to a greater number of students, optimizing adequately the physical and human resources of the institution [4].

In the Autonomous Metropolitan University Azcapotzalco Campus (UAMA) during 2011, an average of 2 groups of the Numerical Methods in Engineering (NMI) course were taught, with a capacity of 50 students per trimester attended by a course teacher, for which attention was given a maximum of 300 students per year on average. However, the demand for NMI groups was increased by adaptations made to study plans of 10 Engineering Degrees. Physical spaces and teachers were not enough to meet the demand. So it was necessary to design an additional alternative to the process of teaching and learning to satisfy the demand of Numerical Methods and Engineering, using existing human and physical resources, then the Big Academic Open Course (BAOC) emerged.

On the other hand, cloud computing offers 3 models of network services: Infrastructure as a service (IaaS), software as a service (SaaS), and platform as a service (PaaS) [5]. To attend a moderate to high enrollment in e-learning platforms in different teaching modalities, there is a tendency to use Service Oriented Applications (SOA) as support infrastructure for Learning Management Systems (LMS) [6] [7]. We must consider that the performance of the hardware is the limit of these systems, so a scalable and highly available architecture was designed. The cloud computing by having servers in a virtualized cluster and the use of software as a service, favors a scalable and highly available architecture [8]. This type of architecture is recommended in Higher Education Institutions such as UAMA [9], [10].

When the LMS is implemented in the cloud computing, benefits are obtained such as: scalability and flexibility when distributing resources, dynamic storage, computing power (processors and memory), this generates savings in its implementation [11], [12].
The use of cloud computing architectures applied in the education field, seeks to increase the educational offer in HEI. Such is the case of Malaysian higher education institutions to implement e-learning with a reduced budget for the operation, they decided to migrate from a data center to cloud services. What reduced maintenance costs. When implementing e-learning in cloud computing, 8 factors were considered: 1) criteria for choosing the provider; 2) strategic planning; 3) security; 4) cost decrease; 5) business need, 6) motivation in perception, 7) benefit in the perception of e-learning, 8) needs in the perception of e-learning by users [13].

The volume of data and information has an exponential growth that generates problems for its administration and storage, because there are difficulties for the recovery and preparation data and backup copies, among others. In this context, companies and organizations want to get the most out of their investments in technology through the planning and implementation of virtualization and cloud computing technologies, to protect data and manage it effectively and efficiently. Government funding for higher education continually decreases in third world countries, which represents a challenge for the management of education. Cloud computing provides multiple solutions to the usual IT models [14].

The use of cloud computing involves taking the data to remote servers. The data security problems that this entails are being addressed, however, the economic and ergonomic benefits are undoubted. For Tunisian universities, the use of cloud computing allows the efficient and strategic use of technology, minimizes implementation and maintenance costs, and proposes a migration, model and architecture strategy to understand how universities can move from the use of local servers to the use of the application as a service [15].

How can users of the cloud service trust the service providers to store all their private data? Reliable computing is one of the new technologies in the last decade, and the integration between cloud computing and reliable computing can create a new architecture for the infrastructure as a service that motivates more users of the cloud service to trust the service providers [16].

2 METHODOLOGY

BAOC emerges as a proposal equivalent to the MOOC applied to school courses. In the conduction modality of teaching and learning process BAOC, almost 90% of the activities are carried out online [17], it is possible to attend a large number of students and the coverage is extended. In the BAOC modality the course is given in an academic context, in contrast to the MOOC modality that is open, students must be assigned a grade at course end. In [18] the recommendation is made to have face-to-face activities to validate that the student acquired the knowledge and skills raised in the objectives of the course, therefore, BAOC works under blended learning. By using MOOC modality techniques [19], large school groups can be attended (from 100 and up to 250 students for the case of the UAM). Interactive multimedia materials are used, for autonomous work, exercises and practical activities, problem solving, short videos of specific topics [20].

BAOC works under the following methodology.

1 To pass the course the student has until the end of the school term to complete the learning activities, in the temporary scope of school courses.
2 In real time, it has videoconference sessions for the resolution of exercises and advice.
3 The communication is carried out synchronously among the participants of the course: teachers, students and advisors (social service students) through a videoconference room and a chat. Discussion forums, email and social networks are used of asynchronous form.
4 The didactic material available for students includes videos, learning capsules, pdf documents, games and solved exercises.
5 Students have an internet connection via mobile devices and can carry out their course activities by this means.
6 In-person evaluations are carried out to validate the student’s learning.
7 Learning communities are organized to encourage interaction among students. This is one of the principles of this BAOC modality, to achieve learning.
2.1 BAOC technological architecture

In order to define the BAOC technological architecture, the appropriate tools are chosen to put into operation the Virtual Learning Environment (VLE) that gives support to the courses taught with this modality [19]. Based on the technological architecture [21] the BAOC architecture is implemented under the cloud computing paradigm as shown in figure 1.

![Figure 1. BAOC technological architecture.](image)

The application layer uses Adobe Connect for the videoconferencing service. The sessions are recorded for later consultation by the student. Sakai is used for the LMS service. They use tools such as: Calendar, Notices, Team Members, Private Messages, Forums, chat, Resources, Tasks, Exams and Statistics.

The platform layer is implemented with Linux operating system CentOS [22]. MySQL as a database server and Apache Tomcat as the application server.

The VMware virtualization platform [23] is used in the infrastructure layer. It is allowed in a simple way to add disk space (storage), memory (RAM), processor (CPU), or network according to requirements, during the delivery of the course. Figure 2 shows the virtual machine created in the VMware virtualization platform.

![Figure 2. Virtual Machine in VMWare.](image)

3 RESULTS

The case study was conducted during 9 trimesters from 11-Autumn (11-O) to 14-Spring (14-P), with the course of Numerical Methods in Engineering, in the Division of Basic Science and Engineering of the UAMA, involving 1165 students.

The results show that only 9 groups were required, in contrast to traditional face-to-face groups with a quota of 50 students, 24 groups were required to attend to the 1165 students who participated, 8 groups per trimester were required, with their respective classrooms. Using BAOC, only one classroom was used to apply exams. In traditional groups, 4 teachers and 4 assistants were required,
with the BAOC modality the students were attended with 1 teacher and 1 assistant. Finally, a student of social service as support in the delivery of this modality. In short, for the field test, human resources only needed a teacher, an assistant and a social service student to attended the 9 groups mentioned. The available human and material resources were optimized, thanks to the BAOC modality.

The results of the retention index are shown in table 1, it is observed that in the first 4 trimesters the retention percentage oscillated between 68% and 74%. In the 13-Winter quarter (13-I), it decreased considerably, reaching 48% withholding, remaining between 57% and 46% until the 14-Spring trimester (14-P).

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Retention index</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-O</td>
<td>68.07</td>
</tr>
<tr>
<td>12-I</td>
<td>73.60</td>
</tr>
<tr>
<td>12-P</td>
<td>73.02</td>
</tr>
<tr>
<td>12-O</td>
<td>68.03</td>
</tr>
<tr>
<td>13-I</td>
<td>48.15</td>
</tr>
<tr>
<td>13-P</td>
<td>57.25</td>
</tr>
<tr>
<td>13-O</td>
<td>56.20</td>
</tr>
<tr>
<td>14-I</td>
<td>51.63</td>
</tr>
<tr>
<td>14-P</td>
<td>46.00</td>
</tr>
</tbody>
</table>

Regarding the approval index, in Table 2, it is observed that there is a pattern in which during the fall trimesters (11-O, 12-O and 13-O) the approval percentage ranges from 54% and 65% are the lowest percentages obtained during the testing period. While during the spring trimesters (12-P, 13-P and 14-P) the approval percentage increased considerably, oscillating between 70% and 77%.

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Approval index</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-O</td>
<td>64.81</td>
</tr>
<tr>
<td>12-I</td>
<td>69.57</td>
</tr>
<tr>
<td>12-P</td>
<td>76.63</td>
</tr>
<tr>
<td>12-O</td>
<td>61.00</td>
</tr>
<tr>
<td>13-I</td>
<td>70.94</td>
</tr>
<tr>
<td>13-P</td>
<td>74.68</td>
</tr>
<tr>
<td>13-O</td>
<td>54.41</td>
</tr>
<tr>
<td>14-I</td>
<td>64.56</td>
</tr>
<tr>
<td>14-P</td>
<td>69.57</td>
</tr>
</tbody>
</table>

4 CONCLUSIONS

BAOC seeks to provide attention to a large number of students and meet the demand with the resources at their disposal in the educational institution. With BAOC, it can attend up to 750 students per year, using a classroom with a capacity for 50 students to take the exams, a teacher and an assistant in each trimester. It facilitates the schedules programming, and impacts on an efficient use of physical and human resources (due to course sessions are carried out online). Flexible counseling is offered to students, they can be connected from anywhere, they do not need to travel to the University
to attend class, and if it is not possible to take it in real time, it is recorded and available for them to consult later.

With BAOC, the average approval percentage is expected to be 68%, with an average retention rate of 61%.

Therefore, the BAOC modality proposal to attend groups with a large size is functional and comparable to the methodology of traditional groups, with the advantage that it makes efficient use of physical and human resources, offering students an option to take advantage and manage better your time.

The architecture in cloud computing used under the PaaS model, allows a better administration and use of resources. It can add memory, cpu, disk or network as required. It is also viable to migrate one instance of the operating system to another, if it were necessary to do so due to the failure of one of the servers involved.

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REFERENCES


