MASSIVE ONLINE ASSESSMENTS. EXPERIENCES MANAGEMENT APPLICATION

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Abstract

The purpose of this paper is to share some of the good practices and lessons learned at the h@bitat puma Program in relation to the management, organization, implementation, and delivery of results in Massive Online Diagnostic Evaluations. The first online assessment was a pilot conducted in 2009 to teenagers between the ages of 15 and 18 who were enrolled in a computer course in high school.

The levels of service implemented in the logistics process, have matured throughout several applications to high school freshmen of the National Autonomous University of Mexico, which in 2013, led to the expansion of the service to three undergrad programs.

For these experiences we have used free software, the collaborative work of a strategic team, and various actors during and between classes, which has been a critical factor for success. The use of various communication channels, as well as the identification and monitoring of key performance indicators (KPI), has contributed to defining processes that generate value to the institution.

Keywords: h@abitat puma, massive assessment, massive online, process, KPI, online diagnostic evaluation, PMI, ITIL.

1. INTRODUCTION

The h@bitat puma Program at the National Autonomous University of Mexico (UNAM) has the main goal of encouraging the development of digital skills in students. One of its main jobs since 2009 has been to implement Massive Online Assessments to contribute to one of the institutional programs that focuses on promoting the use of information and communication technologies (ICT) to strengthen the academic performance of students. [1]

We address the Massive Online Assessments as a strategic service that involves the application of an online diagnostic evaluation, an instrument for students to identify their digital skills. The service is implemented in Moodle and has been offered several times to high school and undergraduate degree students at UNAM; this has allowed us to identify and document the best practices regarding the design, operation, management and closure of Massive Online Applications.

The service will be described based on the five phases of the life cycle proposed by the Information Technology Infrastructure Library (ITIL). To manage the implementation of benchmark assessments, we referred to the model proposed by the Project Management Institute (PMI).

2. CONCEPTUAL FRAMEWORK

The best practices suggested by the Information Technology Infrastructure Library (ITIL) define service as a life cycle that can be iterated as many times as requested. With each iteration, it is possible to identify improvements that lead to the redefinition of the service and thereby, recognize good practices.

The ITIL [2] model focuses on defining the roles (*roles within specific processes*), processes (structured *activities designed to accomplish a specific goal set*), and functions (logical grouping of roles and automated measures that execute a defined *process, an activity or combination of both*) involved in the design and delivery of technology services. The best practices suggested for each of the five phases proposed by the model are:

1. Service strategy. Provides guidance on how to create value from the design, development and implementation of service management.

2. Service design. Provides guidance to innovate: design coordination, service development and management processes. Innovation is in terms of the service architecture, processes, policies and documentation.
3. Service transition. It is a guide in the development and improvement of risk management capacity and to put into operation the new or redesigned services. Includes the management and coordination of processes, systems and functions to build, test and deploy a service.
4. Service operation. Describes the practices and instructions to achieve efficiency, effectiveness and stability in the delivery and support service.
5. Continual service. Provides guidance for the creation and maintenance of customer added value through better design, introduction and operation of the service. The processes of this phase are implemented throughout the service's life cycle with two main purposes: 1) To continuously align IT services with the needs of users; 2) To identify and implement improvements for the services.

The model proposed by the PMI [3] is a framework for managing finite projects and offering a service that demands planning, operation and monitoring. The PMI suggests a five-process group in order to have a successful development project: initiating, planning, executing, monitoring, and controlling and closing processes.

1. Initiating processes. Includes: 1) Identifying requirements; 2) addressing the needs, concerns and expectations of stakeholders, defining communication channels, schedule, resources and risk. The project development is formalized through a project certificate.
2. Planning processes. 1) Answers to what strategies and how they will be taken to achieve the objectives proposed in the Initiating processes group; 2) defines roles and activities; 3) facilitates communication among stakeholders using the matrix of communication, calendar, documents and progress reports; 4) estimates time and risk maps; 5) the lessons learned are documented. [4]
3. Executing Process. Defines and shapes the team. It aims to carry out the activities set out in the planning process. For unforeseen situations that arise during the implementation, preventive and corrective actions will be implemented.
4. Closing Process. Includes administrative closure process as documents, directory of participants, lessons learned, and backups.
5. Monitoring and controlling processes. Actions planned against the actions executed in each of the established processes are compared. Time and budget set is monitored.

3. METHODOLOGY: PROVIDING A MASSIVE ONLINE ASSESSMENT - DIAGNOSTIC EVALUATION SERVICE

To describe our methodology, we will take up the phases suggested by the ITIL and PMI frameworks, so as to recognize the service's life cycle, and to execute the different iterations applied by target audience or educational entity.

Both frameworks have some aspects in common. With the ITIL we have focused on establishing the strengths and qualities of the service itself in context of information technologies; while with the PMI, we have considered it for the management of each iteration.

The scope of this work encompasses the relevant attributes of the different phases of the Massive Online Diagnostic Evaluations service's lifecycle, showing in particular the execution of three iterations -2009, 2012 and 2013 - with the interrelationship of the key areas related to the learning processes of each school or college that receives the service.

3.1 Service strategy

The need to contribute to the strengthening of the scholar performance by promoting the use of information and communication technologies (ICT) in UNAM's high school students, has led the h@bitat puma Program to propose the application of a Massive Online Diagnostic Evaluation.

The implementation strategy of a Massive Online Diagnostic Evaluation takes into account that:

- In high school there are two systems: National Preparatory School (Escuela Nacional Preparatoria ENP) and College of Science and Humanities (Colegio de Ciencias y Humanidades CCH), each with its own organizational structure and particular form of work.
- The technology used is Open Source and facilitates massive student enrollment, as well as delivering immediate results.
- Participation of teachers responsible for classrooms, academic secretaries and academic coordinators is essential.

The promotion of the service is done through meetings with the authorities of the schools involved, where an executive document is delivered as a manifest of the experience and previous mass evaluation's results.

The service starts from when the project is proposed to either the authorities of the General Direction of High Schools (it integrates two systems: ENP and CCH) or to the authorities of the School of Higher Studies. Only for CCH, two periods of application are considered in the same iteration as students can have the computer science subject during either of the first two semesters of their academic training.

The service concludes with the presentation of a report (digital and print) to the authorities of the school system or service that requested the service. The report integrates the analysis of the results of the students, the difficulties presented, and the areas of opportunity for the next application. For undergrad schools, a proposal for the training of students is also included in the report.

3.2 Service design

Implementing online assessments requires two elements: 1) the design of the assessment instrument and 2) architectural and technological infrastructure. In this paper we will focus only on the second item.

Different technological solutions were analyzed and the alternative that meets the requirements of time, cost and quality is the Learnig Management System (LMS) Moodle [5] because it is possible to implement a questionnaire to be answered on a recurring basis that immediately displays the result to the participants (student, teacher, authorities) to a large number of students. Other important characteristics of Moodle for us are:

- Its structure because Moodle is organized into categories. A category that we defined was high school.
- Each category can have two or more courses. In our case, each category represents one school.
- A course can have activities and resources -like a questionnaire- that we use to design the evaluation diagnostic.
- The students can be enrolled on a course automatically by the administrator.
- It is possible to set different levels of permissions for each role like manager, teacher and student.
- The students can answer one evaluation and get the results immediately.
- This platform has a module called "Quiz" which facilitates the creation of banks of questions and question categories.
- It is a global learning management system designed to enable integration of information onto a single platform.
- It is Open Source, feature that has allowed to add or to modify some of the program code in order to personalize its functionality and power the interaction with different type of questions.

As part of the service, the habitat puma Program has created various manuals for topics such as access to the LMS, and lists of users and passwords with the information of students, teachers, advisers, coordinators and authorities.

For the logistics of the application, the requesting entity creates calendars to inform about the schedules and the campus' computer labs designated for the online assessment service.

There are two ways to access the evaluation: 1) from the website of habitat puma (through links that lead to the specific Moodle questionnaire for each entity) and 2) directly from the platform.

3.3 Service transition

The first time the service is brought to a school, its denominated by the habitat puma Program as a "pilot application" because the main objective is to identify the elements of the process that can be improved for future applications, or for the service to be adapted to the audience that is going to be evaluated; for example, readjustments of the times of application or the duration of the service.

In future applications, different aspects are considered, such as computer labs availability, level of participation of the teachers, or the access to the evaluation from various devices.

To provide the service, we have used the infrastructure given by other branches of the General Direction of Information and Communication Technologies (DGTIC) – UNAM, in which the habitat puma Program is appointed.

The LMS Moodle that was used up to 2012 on its 1.9 version was updated to version 2.4 in 2013. This eased the development of some improvements of the grading instrument.

The architecture in Moodle has been redesigned and improved with each iteration. In 2009, first pilot application took place in the ENP, for which 9 LMS were installed, one for each campus. In each LMS both the questionnaires and the students' groups were duplicated, in some cases, the number of questionnaires went up to 48. The processing of the results (near to 300 questionnaires, each with an average of 50 tries) for its analysis to deliver global results to the school's authorities was quite a challenge. In 2013, we used a single Moodle and we took advantage of the category and subcategory features.

The request for students' data to the authorities of the institution optimizes the enrolment process in Moodle, provided that the information is delivered to the habitat puma Program at least one week before the service begins operating. When that information is missing, or a student from a different year has to be evaluated, it's been necessary to create "wild card" accounts with generic users and passwords.

The process of application and considerations to make during the evaluation are revealed through a website specially created to inform about the service.

Some of the risks to be considered and that the program focuses on avoiding in each delivery of the service are: connectivity, access to evaluation, user recognition and password to log in to Moodle.

3.4 Service operation

Massive Online Assessments have matured with each iteration. We present three iterations that stand out because of their impact. For each iteration, we state the purpose, number of participants, and the general description of the relevant aspects experienced during the management process, particularly during the implementation, monitoring and tracking stages.

3.4.1 The first iteration (September, 2009).[6]

- Purpose

To apply the Massive Online Diagnostic Evaluation to the students of the ENP during a computer science session taking place in a computer lab, in each of the 9 campuses of the system.

- Participants

The online assessment was applied to 11,553 students taking a class on Informatics and on Applied Informatics to science and to industry, among the nine campuses of the ENP.

- Description

The application period lasted three weeks, allowing coverage over 50% of the target population. Roles involved were: chief academic computing, teachers, personnel responsible for the computer labs, and student advisors in the computer labs at each campus.

The assessment is applied on campus during class time. The help offered to students to answer the evaluation has two sources: 1) the site provided by the h@bitat puma Program that hosts a web page with FAQ and 2) the teacher at their class.

The students cold see their own score, and even though the teacher had access to the results of their group, only some of them took advantage of this possibility.

Participating in the evaluation was not considered as part of their class score, so the student was requested for a printed proof of his/her participation.

This iteration required 9 Moodle sites, one for each campus. At the end of the application period, the access was closed and backups were created. However, 180 days later, it was necessary to restore the sites again to obtain, process and analyze the results. The results report that was delivered to the authorities of the ENP, consisted of an executive summary. If the authorities of the ENP needed to know the details of the results, they were given access to the platform, which remained open during the following school year.

- Lessons learned

To ask for and gather printed proof of participation turned out to be a pointless task, because a register of the participation remained on the platform. The administration of one Moodle instance per campus required more efforts during the making of the backups, and the analysis and integration of the information.

- Benefits obtained

The first Massive Online Assessment pilot was applied. Areas of opportunity (administration, organization, and logistics) were recognized for future applications. Computer science teachers saw first hand the strengths and weaknesses of his/her group. The college of Information technology got quantitative data about students and ICTs.

3.4.2 The Second Iteration (august 2012 and january 2013). [7]

- Purpose

To apply the Massive Online Diagnostic Evaluation to students in the first year of high school, during a computer science session within their computer labs.

- Participants

The online evaluation was applied to 30,889 students from 14 different high school campuses (9 from ENP and 5 from CCH).

- Description

The application period lasted two to three weeks, allowing the instrument to be implemented to more than 80% [8] of the population considered at each school. Roles involved in the implementation were: academic directors and secretaries of each system as the invested party; CCH in the planning and coordination of the computer secretary, and the ENP computer coordinator and head of the college of information technology as intermediaries to arrange dates and exchange data. At each site, planning coordinators, personnel responsible for the computer labs, teachers and scholars, were key at ensuring the correct procedures of application to the students, in addition to assisting them to solve doubts.

The assessment was implemented at each campus during a school day. The student knew the end results at completion.

The aid received by the student was provided by the teacher in the computer lab on campus and only during the time allotted to answer the evaluation. A website was provided for those responsible of implementing the evaluation on how to participate in the evaluation, how to report progress of participation, contact information of people on campus and to announce the schedules of the computer labs.

The assistance was provided to students by a teacher during class in the computer lab The teacher and other assistants in the classroom had access to a support website which had instructions for each student on how to apply evaluation. In this site daily progress was reported, and it also provided contact details, and computer rooms and group scheduling.

During the application of the assessment, connectivity, current evaluations, and registered global progress were closely monitored. The participant entity is informed of the process through the evaluation's website. If the student couldn't log in to the questionnaire with the user and password assigned, the assistant in charge has a list of generic users and passwords that grant immediate

access. Another aspect to acknowledge is the recognition of some faults or incidents presented during the application, this with the main purpose of preventing problems, identifying risks, and presenting possible solutions for future iterations. The source of communication and follow up for all the parties involved is concentrated in a help website: https://sites.google.com/site/ticometro2012/

Once the application period ended, all the data was extracted from Moodle, then processed and analyzed for the creation of the report. The report is available in digital format in habitat puma Program's website and a printed copy was delivered to each of the headmasters of the campuses; it contains the results of the evaluation, the difficulties presented during application, and a proposal of suggested topics that will help develop their students digital abilities. The institution learns about the preliminar global results through the help website.

- Lessons learned

The complexity of the passwords assigned to the students resulted in an excessive use of the "wild cards". It is possible to exclude some data during the global analysis of the population. Dividing the application into two periods for CCH, meant double efforts in management, from organizing visits to campuses, to the analysis of the results, this also resulted in an "experience gap" between students. Over 50% of the incidents reported, were related to the capacity to load images, element associated with the quality of connectivity. The chance to mature on the version of Moodle to improve the performance is being considered

- Benefits obtained

The evaluation was able to be applied in both high school systems during a one lesson period. The improvements to the platform, after updating to version 2.4 of Moodle, have been key when designing new features, adjusting resources and aiming them towards infrastructure for the optimization of the server's performance, as well as adding complements to Moodle's basic features. This has given place to customization of the questions in the evaluation. The results reports are available online and printed copies were handed to the institutions' headmasters.

3.4.3 The third iteration (august-october, 2013)

In this iteration, the high schools participation is considered and for the first time, colleges [9].

- Purposes

To apply the Massive Online Diagnostic Evaluation to students in the first year of high school, during one computer science session in their computer labs.

To apply the Massive Online Diagnostic Evaluation to students of the first semester of college in the National School of Social Work (ENTS) and the National School of Nursing and Obstetrics (ENEO) during the time of one lesson.

- Participants

In this evaluation that lasted from august to september of 2013, 31,939 students from the 14 high school campuses participated, and between september and october of 2013, 820 undergrad students from 2 schools (ENTS and ENEO).

- Description

The period of application lasted two to three weeks, which allowed the online evaluation to reach 88% of the high school students, and over 60% of the total student population enrolled to that school cycle. The roles involved in this application were: academic secretary, technology coordinator, the staff in charge of assisting inside the computer labs, and interns.

The students could see their results at completion; the institution learned about the preliminar global results by accessing the platform and through the help website created for assistance during the application of the service.

During the application of the assessment, connectivity, current evaluations, and registered global progress were closely monitored. The participant institutes were kept up to date through the help website, where a daily report of the progress of each campus related to the number of groups scheduled were kept; the student-computer ratio was taken in consideration for the capacity of simultaneous application, which can directly impact loading time and concurrency of the server. This was also monitored in real time through Google Analytics. The site for collaboration and follow up for

this iteration was https://sites.google.com/site/ticometro/. Over 50% of reported incidents were about deficiency in connectivity.

When the application period ended, a backup of the student's answers was made. The report of the evaluation was delivered in digital and printed format to the authorities of each campus; it contains the results of the evaluation, the difficulties presented during application, and a proposal of suggested topics that could help develop their students digital abilities.

- Learned lessons

Communication with the authorities, the daily report and in site assistance were key factors for higher levels of student participation. The aid provided came directly from their teachers or the interns that assist during the application; however, to compensate for the connectivity deficiency, a lot of students took the test from home, which set the tone for other, more direct channels of communication with them.

- Benefits obtained

The first pilot application for undergraduate students was made, with which new areas of opportunity were discovered (management, organization and logistics) for future applications. The schools obtained qualitative and quantitative data that allows them to establish action strategies towards the development of their freshmen student's abilities in the use of ICTs.

3.5 Continual service

Continual service improvement ensures that the services provided are aligned with the current educational needs, this by identifying and implementing enhancements to the IT services that support Massive Online Diagnostic Evaluation processes during each iteration, considering target population, number of students and number of campuses each time. The performance of the IT service provider is constantly measured and improved in order to increase its effectiveness, and time and cost efficiency. This improvements are also considered for the online diagnostic evaluation, the Moodle version, the server, the connectivity and the devices availabilities, therefore, nowadays we are working in the development of several communication channels, such as a live chat to assist students in real time, a one-account format for all services to avoid the use of "wild cards", and video tutorials that explain the basics of the test. These improvements are the product of the lessons learned during the operational stage.

4. DIFFICULTIES FOR APPLYING THE MASSIVE ONLINE DIAGNOSTIC EVALUATION

Some technical difficulties that appeared in different iterations were: late delivery of the schedules of application, sometimes just a few hours before it happened, which led to deficiencies in the assistance given during application. Regarding the computer equipments, the main issues presented were failure to connect to the Internet and outdated browsers which in some cases, it even resulted in the inability of the students to finish the test.

Each campus has different providers of connectivity services, some are private, but most of them are provided by the DGTIC, but the internal management is autonomous in each campus. However, with this effort, a direct communication developed between UNAM's NOC, the habitat puma Program, and the campuses' network responsibles that allowed the monitoring of the service's performance. During these iterations, the connectivity service was of just 10 MB per campus, now, it's increased to 100 MB, this brings new challenges to the table, both in the management of each campus' internal network, and in the creativity to enrich the possibilities of future Massive Online Assessments.

In regards to the portion of students that weren't able to participate, it is worth mentioning some aspects to be considered as risks for future iterations. In the high school campuses, computer science teachers must give up one of the few hours assigned for their subject during the semester to apply the test. The lack of interest from authorities leads to scarce participation from students. The null participation of online mode students, despite receiving invitations and instructions via email and the help website. During the pilot application for undergraduate students, the ones that didn't attend class the day of the evaluation, didn't take it later.

5. BEST PRACTICES

The h@bitat puma Program has applied Massive Online Diagnostic Evaluation in over five occasions, this experience has allowed us to identify some good practices that will improve the service given to the participating schools through the experience and adaptation of processes according to the characteristics and needs of the school and its population.

5.1 At the beginning of the service

- To get the authorities in context regarding the range of the project, in addition to assisting to the pitch meeting, making and sending an executive document with the objectives, description of the evaluation, requirements and previous results, is a very valuable asset.
- The participant entity (school or faculty) should formalize its participation in written form, where it's stated who from the campus is going to be in charge of the application, e.g. the academic secretary or the tech coordinator.
- To establish the reach of the mass evaluation, considering time and human and technological resources.

5.2 For planning

- Define very clearly the roles (responsible of computer lab, coordinator, academic secretary, student, among others), responsibilities, and processes of everyone involved.
- Academic secretaries and career coordinators are responsible of informing their teachers and students the goals and dates of the evaluation.
- Elaborate a matrix for the assignation of responsibilities (RACI) in which all the roles and obligations are established, aiming toward identify who makes the decisions, who solves the student's questions, who solves the technical issues and by who and how are the students invited to participate.
- Make a calendar of application with the career coordinators or academic secretaries of each campus, as well as a logistics calendar in collaboration with the personnel in charge of the computer labs, this to assign classrooms, dates and times in which students can go to solve the test.
- Train - in a one hour session- the staff that will be solving questions on campus.
- Consider an application period of two to three weeks. In our experience, the first week has up to a 50% participation rate.
- Applying the evaluation during the first weeks of the school cycle broadens the students participation because they have less activities.

5.3 During operation

- Set up Moodle to grant direct access to each questionnaire from the moment the student enters the platform. This requires: the use of categories and subcategories which will also ease the download of the results for their future analysis; avoid the creation of groups; do massive enrollments of students in the LMS to assign them to their questionnaire.
- Verify the complete delivery of the students information for enrollment. The information must be handed beforehand by the school. While enrolling the students, establish their student ID number as user and password for access to the platform.
- Reserve a computer lab to apply the instrument to scheduled groups.
- Send the students an invitation to participate in the evaluation via email. This will only impact 20% or less of the target population.
- Give the students a brief explanation of the importance of their participation and what benefits they will get out of it.
- Solve doubts and give proper orientation to the responsables of the computer labs, academic secretaries, and career coordinators via email, telephone assistance and help website during the whole process: before, during and after the application of the evaluation.
- The company and communication given to the students is a key factor for success because they contribute to the percentage of participation and reach, and help avoiding and solving incidents.
- Assist the students during the application through different mediums: assistance in the classroom, videos, help website, chats, etc.

- Set up a help desk for the established period of time.
- The chat, website, telephone assistance, help desk and -to a lesser degree- email, are the most used channels of communication during application.
- Download from Moodle all the students' answers as soon as the conclusion of the period of application is confirmed by the school's authorities.

5.4 For follow up and control

- Inform career coordinators or academic secretaries of each campus of the daily progress (number of tests answered). This information makes taking decisions about extending the application period, assigning more assistance inside the classroom or training more staff easier.
- Monitor the connectivity service to put to practice preventive measures that avoid the cancellation of the application.
- Identify the areas of opportunity for continuous improvement in the application and the process and delivery of results.
- Timely attention to the help requests by the users, via online questionnaires.

5.5 For closing

- Do backups of all the courses created in Moodle with all the answers of the students.
- Update the information of everyone involved in a directory of participation with names, positions, and responsibilities.
- Document the learned lessons.
- Deliver to the participant entity a report with charts and graphs of the global results, and include a proposal on how to implement actions that help students strengthen and develop the digital abilities that were diagnosed as areas of opportunities.

5.6 For the improvement and continuity of the service

- Define indicators and make the value of each one available.
- Define metrics for each indicator, so as to be able to make timely decisions.
- List some defined KPIs for the observation of Massive Online Applications: participation by campus, faculty or career, number of students that finish the evaluation, number of students that don't send their evaluation, level of participation of each role assigned, classrooms availability, devices in which the students can take the evaluation, quality of the internet service, server performance, Moodle version, access points, peak times, chat conversations, register of doubts in the help questionnaire, requests for accounts to participate.
- Using a model or framework for the management of the service contributes to a continuous improvement.

6. CONCLUSIONS

ITIL was a useful framework for the improvement of the service throughout all its phases, while the PMI contributed to the efficient management of each iteration, with which we obtained the lessons learned. These lessons learned were supplies for the ITIL phases, of which results are the best practices presented here. In the future, with the best practices, we will work on the integration of a projects portfolio for the management of the ITIL phases.

Throughout these experiences, interacting with different roles has been very valuable, because it allows a multidisciplinary practice that enriches the service as a whole and the management of the various iterations, where we have found particular needs for each entity. The alignment with the strategic plan of the University has favored the efforts to increase the use of ICT among the students.

The improvement in the service levels for the Massive Online Application of Evaluation, is closely linked to the Universities' efforts to improve its IT services, such as connectivity and computer equipment inside the classrooms, which ultimately benefits the teaching practice by involving the use of ICT in academic purposes.

This effort opens up future lines of work for the growth of projects associated to development of digital abilities, in addition to broadening the target audience: today, it's just aimed towards the population

that is starting its college education; however, interest has arisen amongst teachers, alumnus, and even the general public. If the service were to be solicited by other institutions or audiences, we have identified the elements necessary to study their particular needs and assess the execution.

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