

Math Without STRESS – An Open Online Learning Project

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Abstract: MOOC (as an acronym for Massive Open Online Courses) are a quite new model for the delivery of online learning to students. As “Massive” and “Online”, these courses are proposed to be accessible to many more learners than would be possible through conventional teaching. As “Open” they are (frequently) free of charge and participation is not limited by the geographical situation of the learners, creating new learning opportunities in Higher Education Institutions (HEI). In this paper we describe a recently started project “*Matemática 100 STRESS*” (*Math Without STRESS*) integrated in the e-IPP project | e-Learning Unit of Porto’s Polytechnic Institute (IPP) which has created its own MOOC platform and launched its first course – Probabilities and Combinatorics – in early June/2014. In this MOOC development were involved several lecturers from four of the seven IPP schools.

Keywords: E-Learning, Higher Education, MOOC, Online Learning, Open Learning.

1. INTRODUCTION

Open Educational Resources have been widely discussed on a global level. Based on the UNESCO 2012 Paris Declaration (UNESCO, 2012), Open Educational Resources (OER) are any type of educational materials in the public domain or released with an open license that allow users to legally and freely use, copy, adapt, and re-share. OER present a strategic opportunity to improve the quality of education as well as facilitate policy dialogue, knowledge sharing and capacity building. The Declaration settles the importance of OER and gives recommendations to governments and educational institutions, among others, around the globe. The European Union has started a large-scale initiative on “Opening Up Education”.

The idea of placing course materials online is not new. Since the early 2000s, HEI have provided online access to all kind of course resources like lecture notes, assessment materials, lecture recordings, among others. One of such precursors was Massachusetts Institute of Technology OpenCourseWare (MIT OCW), a project created in 2002, where materials for approximately 2150 courses are available, among these course materials are complete sets of video lectures available for about 50 courses (MIT OpenCourseWare, 2002).

According to the (Europe 2020, 2010), smart growth denotes strengthening knowledge and innovation as driver forces of our future growth. This involves improving the quality of educational systems, increasing research performance, supporting innovation and knowledge transfer, making full and better use of information and communication technologies and certifying that new ideas can be turned into different products and services that generate growth, quality jobs and help to face global social challenges.

The definition of strategies related to new ways of teaching and learning has been a constant concern inside our institution, in particular in the long-distance learning domain, either through e-Learning or b-Learning and, recently, through “open-Learning”, where the MOOC play a major role. Relatively unknown until sometime ago, MOOC have brought a ‘tsunami in education’ as some call it. The years 2012 (Pappano, 2012) and 2013 (Booker, 2013) are frequently named as ‘the years of the MOOC’ and it becomes obvious that we are presently facing and experiencing significant changes in HEI, and education in general. The way we take advantage of all the new technologies developments, in a constructive knowledge improvement perspective, is a new challenge for HEI as they must stand as the “pillar” of knowledge source (and resource) “obliging” each and every one involved, as actors in HEI work process and performance, to be in the entrepreneur and innovation “wave crest”.

Every year, Higher Education Institutions (HEI), particularly those in which Mathematics is a necessary pre requisite for their courses, have to face the problem of students with different levels of mathematics knowledge and skills. Over the years, HEI have been made several attempts to tackle this issue. Bearing in mind this problem and the remarkable success that MOOC have been showing, we felt that students, as well instructors, could

benefit and take advantage from this new educational paradigm in order to expand their knowledge and profit from the available opportunities to learn Mathematics online.

In 2013, IPP launched its own MOOC platform - OpenED. This project development gave us the opportunity to create the first IPP MOOC, named “Math Without STRESS” (or in its original version – in Portuguese – *Matemática 100 STRESS*) which consists of three different Courses: *Probability and Combinatorics*, *Introduction to Differential Calculus* and *Trigonometry and Complex Numbers*. Our main goals were to create a useful tool that may well:

- Help pre-university students to prepare for the National Mathematics Exam – all the contents were carefully built with this objective in mind;
- Allow the public in general to refresh or gain some training in the contents developed, for each item;
- Give a friendly way of managing each one’s learning commitment;
- Harmonize the different Mathematics backgrounds of the students – fill in the gap between high school and higher education.

This particular course was chosen also by a combination of other factors:

- Previous team experience with e-learning systems, for instance, granted by MatActiva Project (Lopes, Babo, & Azevedo, 2008) and Learning Management Systems (LMS) use in our own courses, helped us to structure this first MOOC;
- Attract new “future” students for IPP;
- Increase national and international visibility of the IPP;
- Importance of developing a new teaching model and learn by doing methodology.

2. DEVELOPMENT

The e-IPP project – e-Learning Unit from Polytechnic of Porto – was born with a generic and globalizing vision, focusing on the development and implementation of new ways of teaching/learning/training among the IPP Community and in its area of influence, with an innovative and dynamical attitude, targeting training needs throughout life, through a continuous learning process, consistent with advances in science and communication technology, enhancing/facilitating/promoting space and time extensions. Following its goals – Promotion and development of distance education in a national and international level, fostering research and the use of digital pedagogical practices adapted to the style and the technological learning contexts promoting/implementing an educational model that allows to support/follow the student/graduate – the e-IPP created, as we have already stated, its own MOOC platform – OpenED. Accessing the OpenED site www.opened.ipp.pt (see Figure 1) participants can see the available courses as well as they can suggest new ones, by using an integrated message system.



Figure 1: Screen Shot of <http://www.opened.ipp.pt> (12/07/2014)

2.1 Probabilities and Combinatorics Course

Probability and Combinatorics is the first MOOC to be released by IPP, available to the public through OpenED platform. This is a course in a virtual learning environment open to all those who wish to participate at their own pace, without mentoring, allowing users total freedom and flexibility of schedules.

This course “design” was based on the sections of Probability and Combinatorics program and respective curricular goals of the Mathematics subject of High School (DGE, 2002) (MEC, 2014), aiming to contribute to a change to the way of teaching and learning Mathematics are often seen and practiced. Meanwhile, this was also an opportunity to try to contribute to the student’s motivation through a set of interactive materials at their disposal, completely adaptive and adaptable to their needs. Thus, its main goal is to promote and develop the self-study, the active cooperation and interaction of participants through the forum, trying to provide a dynamic and rewarding learning experience.

2.1.1 Target Audience

- Pre-college students or individuals with basic knowledge in Probability and Combinatorics wishing to update their knowledge in these areas or prepare for the National Exam of Mathematics (Code 635);
- Higher Education students who have not attended in High School, this subject, and who feel the need to acquire basic knowledge about some of the topics covered;
- High School Teachers who may use these resources with their students allowing them to develop teaching methodologies like "Flipped Classroom" (Melo, Amorim, & Rosa, 2012).

2.1.2 Course Methodology

The course starts with an entry test, not mandatory, named as “DiagnostED” with only 12 questions, which includes a diagnostic scoring report to help students to identify strengths and weaknesses in some topic areas, and provides students with a clear and objective perception of their initial knowledge on the subject.

Probability and Combinatorics Course (PCC) consists of nineteen different modules/lessons spanning four weeks, with a weekly average dedication of three to five hours. Topics covered include: The Random Experiment and the Sample Space, Events and Operations on Events, Probability and Properties of Probability, Exclusive Events, Conditional Probability, The Intersection (and) Rule for Independent Events, Independent Events, Law of Total Probability and Bayes Theorem, Fundamental Counting Principle, Factorial of a Natural Number, Permutations, Combinations, Pascal’s Triangle, Newton’s Binomial Formula, Probability Distribution, Binomial Distribution and Normal Distribution.

Each module has two distinct sections (Figure 2) – Video Lectures – addressing the fundamental concepts, accompanied by examples and solved problems, and the section – Proposed Exercises – a group of 5 randomly selected questions, from a question bank specifically created for this course, to be solved for consolidation of learning providing furthermore sequential moments of self-assessment.

Figure 2: Module corresponding to the Pascal's Triangle. Screen Shot of <http://www.opened.ipp.pt/> (12/07/2014)

Concerning Video Lectures, (Vieira, Lopes, & Soares, 2014) are of the opinion that video style have different effects on learning performance and students' enrolment. We chose the very popular Voice Over Presentation style, whose main component is usually a PowerPoint presentation, complemented with a voice over explaining the slides. The videos duration are between 5 and 10 minutes and were created with Camtasia Studio software for a dynamical editing.

With regard to Proposed Exercises, participants can take multiple attempts at each one of them. This can help to make over the quiz taking process into an educational activity instead of a simple assessment. Since all the nineteen quizzes are randomized, the student will get a new version in each attempt, which will be useful for practice purposes. Feedback is provided for each question, allowing the students to see a proposed solution, step by step, as showed in Figure 3. The Pool of Questions, from which the quizzes are randomised, is categorized separately by learning items (modules) and each section has four subsections, namely: Easy, Medium, Difficult and National Tests/Exams.

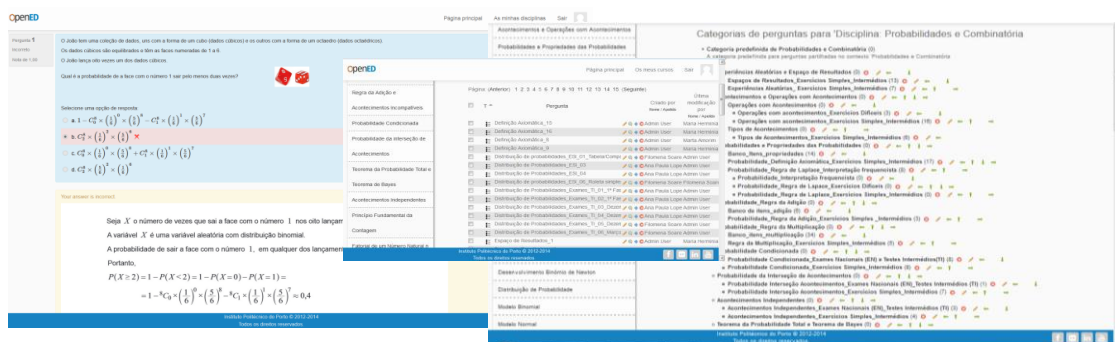


Figure 3: Screen Shots of Categories/Questions/Feedback <http://www.opened.ipp.pt/> (12/07/2014)

The course "ends" with a Final Knowledge 20 questions Assessment Test that participants can repeat three times, at most. If the quantitative result on this test is equal or greater than 75%, the participant may obtain a Participation Certificate. All materials, including layout, design, content, pool of questions, mascot, etc., were created from scratch for this course.

2.1.3 Discussion Forum

According to the course format, this forum will work, for now, as a forum for discussion among participants. However, to encourage their use, there will be an interaction with the team that developed the course. We expect that users take advantage of this feature by putting their questions and feeling free to open new discussion topics. We intend to launch, as well, an open question forum – “Doubt Ed” – were participants may question instructors and other participants about all kind of doubts they have in course context. There is no limit to the number of discussion topics that can be opened in a course, so it is important that the forums have an almost direct and synchronised follow up in order to be well organised and “profitable”.

3 CONCLUSIONS

The last few years have been dominated by technology that is significantly changing the relationship between instructors and students; as such this gives educators the opportunity to design learning and teaching differently.

Although MOOC have been growing substantially worldwide, we can consider that these are still in an embryonic stage and in particular this course is far from considered "finished". Whenever a new content was developed and introduced, we felt that the "perfection" was far from being achieved. Recordings and reworking, editing and corrections have been a constant through this half year of work that generated this course. Being perfection something intangible, we decided to open a first version of this course, in a somehow different format than originally planned, pursuing a kind of open pilot that allows us to constantly improve all the work done and make use of all the piloting information from this embryonic first one. All activities are registered, all opinions and feedbacks will be summarized and we will try to complement these courses with a learning analytics process.

With this outstanding experience we realize that the development of a MOOC is a huge intellectual and organizational effort. Miles away from perfection and with a lot of open questions and challenges, we want to share our project and experience, having always in mind that our students were already born in the digital era, responding and reacting very differently from outside stimulus than we did or even do.

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