Massification and personalization, the apparent antinomy of the MOOCs

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Massive Open Online Courses (MOOCs) rather than standardize and make impersonal the learning experience, as one might superficially believe, represent an extraordinary context to validate original personalized learning strategies. The tracking of interactions produced by massive learning communities enables the crowdsourcing and offers new features based on models of probabilistic analysis. These perspectives are analyzed through functionalities and trials in two of the most important MOOCs providers: Khan Academy and Coursera.

KEYWORDS: MOOCs; Personalization; Intelligent Tutoring System; Khan Academy; Coursera.
Introduction

The creation of a learning environment adaptable to the specific needs of each student has been a central goal of educational technology since the beginning of the mass education process. The pursuing of this goal, between the engineering and educational vision, not always has produced a cross-fertilization, which is an essential component for interdisciplinary areas (Rossi, 2012), but it is undeniable that the research field has been influenced by developments of both domains. Along with the spread of tools for personal use (PC and personal productivity software), which led the computer science in the past decades, in the educational area we have witnessed to the development of tutoring systems which, based on the promises of the AI, have tried to reproduce synthetically the experience of a human tutor alongside the student. The theoretical limitations, even before technological ones, of this approach began to become clear around the 90’s of the last century when the educational research has provided rich insights into the importance of the social dimension of learning as well as the emotional (motivation, self-regulation, self-perception) and contextual (situated-, active-, peer-learning) components. It is not a coincidence that during the same years the development of digital technologies were no longer led by the needs for personal productivity, but by social networking needs with the development of information, communication, collaboration and participation tools. Whenever these developments have been ignored in the field of educational technology, following a monadic, atomistic and individual view about learning, researchers have encountered the insuperable ontological and reusability issues of the Learning Objects, or the low level of theoretical consistence for Personal Learning Environments. Today there are new more consistent paths that leverage the new social dimension emerging from the global interconnection.

1. Massification and personalization

It may seem paradoxical, but today the most promising prospects for tutoring and personalization come from the biggest process of massification of learning, as we are witnessing with the rise of MOOCs (Aoki, 2013). Theorized on connectivism since 2008 by Stephen Downes and George Siemens (Downes, 2008; Siemens, 2008) MOOCs have been readapted by enterprising professors from accredited universities in order to give a free access to their courses worldwide. Lecturers and involved universities reputation has attracted an instant huge interest. In 2011, the forerunner course on “Artificial Intelligence” conducted by Sebastian Thrun and Peter Norvig of Stanford University reported 160,000 students from 190 countries. The success has given rise to startup as Udacity, Coursera, edX that now offer hundreds of courses with tens of thousands of students through agreements with the most prestigious universities (Jordan, 2013). It is appropriate to consider the reasons behind this success. The initiative OpenCourseWare has freely posted video lessons of entire syllabus at MIT since 2001. Although universally appreciated, it has not had the same impact of MOOCs. An element of discontinuity is found in the strategies of students involvement (Feld-
MOOCs are not a collection of open educational resources, but online courses to all intents. If you want to attend them you must perform specific tasks with deadlines to meet, but on the other side they offer you the opportunity to be part of a global community created on specific interests of learning. The ability to create an engaging and effective online community with tens of thousands of students is the keystone and at the same time the challenge that are facing MOOCs. The adopted strategy consists in personalization, understood as not an adapting of the technology at the paces, at the times and at the styles of each student, nor the student’s self-determination of the processes and contents, but as an experience of personal involvement that enhances the participation of each student to the success of the course (Norvig, 2012; Koller, 2012; Duneier, 2012).

To create this experience in an online course with tens of thousands of students MOOCs transform the problem in the resource. It digs in the enormous wealth of data produced by the tracking the interactions and relies on the mechanisms of crowdsourcing. The analysis of data to customize learning has always driven the development of the ITS (Woolf, 2009), but the rise of MOOCs has dramatically changed the width of the available data (Weld et al., 2012), and when the order of magnitude of an entity changes, also the mechanisms that it produces change (Anderson, 1972). The dynamics of collective intelligence (Lévy, 1996) and of wisdom of crowds (Surowiecki, 2007) have created a whole new ecosystem in MOOCs. Let’s see how these strategies are implemented by two of the most successful providers: Khan Academy and Coursera. We are dealing with two different environments: the first relating to K12 education adopts an asynchronous strategy, the second is aimed to higher education with a synchronous development of the courses.

2. Khan Academy

The idea of an hedge fund analyst to video record himself to maintain his commitment to help his cousin with maths despite the transfer to another city, has become in a few years the most popular online learning environment (Sahlman & Kind, 2011). What turned disposable videos into a site with 6 million unique users per month has originally been the crowd of YouTube users (Davies, 2012). It currently offers over 4,200 video lessons and is implementing original functionalities thanks to funding from investors like Google and Bill Gates.

2.1 Personalization strategies

The factor that has determined its popularity lies in the multiple elements that allow to live the Khan Academy experience as highly personal:

– the free access, considered not simply free of charge, but as an environment freely available. The whole set of resources is available and the access is immediate to each of them without fixed routes or other limitations;

– the structuring of large disciplinary areas in hundreds of short, self-consistent and strongly interconnected video lessons. This creates a network that pro-
vides both the ability to deal with specific issues and to be oriented in organic paths;
– the video lessons last about 10 minutes. Originally this was YouTube upper limit. Today it is intentionally adopted by all providers also in higher education to keep the attention and to modularize the topics (Sahlman & Kind, 2011);
– the communicative style of the video lessons is not teacher-in-classroom like, but tutor-alongside-students like. The videos are not lectures, but informal talks, which seem improvised and may contain mistakes and variations, just as it happens when you explain something to a friend (Davies, 2012);
– the integration of video lessons with exercises allows the student to get immediate feedback of the achieved skill on topics. It is an effective tutoring strategy that permeates the whole environment and activates mastery learning (Glance, Forsey & Riley, 2013);
– the personal profile provides the evidence of the activities, achievements, acquired skills and goals. Each activity is recorded by the award of badges that not only testify the achievement of disciplinary skills, but also social interactions activities, such as participation to forums.

This isn’t a complete list of the capabilities of the Khan Academy, it is intended only to highlight the main issues related to personalization.

2.2 Learning analytics

The functions described above are tested and recursively improved by using the huge database produced while tracing the interactions. The learning analytics system tracks the video lessons views, the exercises performance, the mistakes, the contributions in the forums, etc. It allows to infer useful information for personalization, such as the propensity to explore resources freely or in suggested route, the ability to support the quiz without displaying the video lessons, the abuse of suggestions in tests, and the forum collaboration (Muñoz-Merino et al., 2013). These analyzes allow the implementation of personalization strategies as well as the overall improvement of the functions. A significant example of the potentialities of learning analytics comes from the analysis of the evolution of the algorithm developed for determining the proficiency, documented by an internal (Hu, 2011). Originally, the test for determining whether a user reached the proficiency in a given domain was to answer a strip of 10 exercises in succession correctly (performance shown as streak). A rudimentary mechanism that has produced multiple cases of positive and negative falses. We can easily understand that it is not the same thing getting a streak correct at first attempt or after endless tests. Moreover, it is very frustrating to have to repeat a streak for committing a trivial typo in the last exercise. Defining competency as the probability above a certain threshold to respond correctly to the nth exercise and using logistic regression, has come to implement a more reliable model engaging students in a smaller number of exercises. It is just an example but it let us guess how probabilistic models can be applied and refined recursively, using the interactions analysis.

It should be noted, however, that what seen has to be referred to the functionalities of an innovative online tutoring environment. Another matter is to consider Khan Academy as the school of the future (Khan, 2011), in fact we do not
share this analysis since a large part of its popularity stems from its being functional to the school as it is today (Noschese, 2011). Anyway, this is not calling into question its value as a whole, but allows us to frame it in a more appropriate educational perspective, such as the flipped classroom, where it can be a resource (autore, 2012).

3. Coursera

Coursera is a spin-off of Stanford University leading provider of MOOCs in higher education. Unlike Khan Academy Coursera uses a synchronous mode with the scheduling of courses in which cohorts of students progress through the curriculum in lockstep (Koller, 2012). This limits the free availability of resources, but fosters the development of communities on which Coursera aims to produce personalized learning experience. The free access to the courses taught by lecturers from the most prestigious university attracts students from all over the world, establishing heterogeneous communities for culture, approach to the study, formae mentis, but also cohesive in the interest of specific disciplines. Here it is an analysis of some of the strategies adopted by Coursera to turn the crowd into an effective learning community (Wenger, 1998).

3.1 Forum

The discussion forums have played an important role in the constructivist mold e-learning and are a basic element of LMSs for the development of a sense of belonging to a learning community (Garrison, Anderson, & Archer, 2001). Even in Coursera the discussion forums represent an essential tool for participation and comparison, but a crowd of tens of thousands of students cannot communicate with the same dynamics of the usual LMSs. The discussion forums then are reinvented with crowdsourcing, probabilistic analysis, reputation systems and solutions based on the new context. Here are some elements:

- the definition of specific topics such as the video lessons, assignments, some problematic aspects of the course contents, etc. This approach fosters an orderly development of discussions and minimizes the proliferation of threads on the same topics;
- the check on the contents of the posts before sending. A process based on textual analysis controls the subject of a new post and displays links to threads or posts that deal with the same subject, before typing the text of the post;
- an easy voting system (thumb up or down) relies on the crowd for assessing the significance of the post. The system brings on the top the related threads and posts and relegates to the bottom those considered less significant;
- a structured and progressive set of badges (bronze, silver, gold, diamond) for each activity in the discussion forum such as read posts, reply, vote, start a thread, receive votes, which strongly encourages virtuous behaviors of participation, cooperation and support. It is an efficient system of reputation,
always visible next to the name of each student and that weighs on everything that concerns him, including opportunities for future employment. If you attend some courses you can easily check how these seemingly simple mechanisms make the comparison between thousands of students in a discussion forum often more ergonomic and productive than the far less populated ones in traditional LMSs. It has been calculated that the average time in which it is possible to get feedback from other students in the main Coursera classes is 22 minutes (Koller, 2012): a data barely comparable with data of the usual online courses and which highlight the potential of MOOCs even compared to face to face courses. Meaningful are also the comments about how a MOOC can be lived as a personalized experience. In 2011, one of Sebastian Thrun’s and Peter Norvig’s students of the course “Introduction to Artificial Intelligence” on Udacity wrote: “This class felt like sitting in a bar with a really smart friend who’s explaining something you haven’t grasped, but are about to.” (Norvig, 2012). In the course “Introduction to Sociology” conducted by Mitchell Duneier on Coursera two students wrote: “It has been an incredible experience for me, one that has not only taught me sociology, but the ways in which other cultures think, feel and respond. I have many new ‘friends’ via this class. ...” and again “It started as intellectual activity but it’s ending in an indescribable emotional relationship with all my classmates.” (Duneier, 2012)

It should be noted also how this context constitutes the ideal environment to experiment with new features. For instance, an algorithm to assign different weights to the votes according to students’ different reputation, to make more effective the evaluation system, can be easily tested and recursively improved using subsets of their enormous dataset. Even for the purely technological aspects, the Software as a Service (SaaS) model of MOOCs shows significant advantages over conventional LMSs. In the former, the experimentation is intrinsic, in the latter, the development of the software, the deployment and the upgrades of the various instances seem no longer sustainable processes. This matter is no longer considered, regarding the feedback that a teacher can receive on his/her course from a global cohort, that certainly deserves to be considered, but that is beyond the aims of this contribution.

3.2 Peer-assessment

To provide feedback on assignments in a MOOC is a challenge that cannot be sustained with a traditional approach. Up to now the majority of MOOCs have adopted structured tests because they allow an automatic assessment, but not all the knowledge can be automatically evaluated with a multiple-choice quiz. The ability to formulate mathematical proofs, develop projects, and produce essays requires open-ended evaluation tools. To meet this need Coursera is experiencing promising models of peer-assessment. Previous studies suggest that when properly managed, for example by defining a clear rubric, the peer-assessment has a extremely high correlation with teacher-assigned grades. (Sadler & Good, 2006). It is widely known, however, that the peer assessment has several issues, such as the reliability with which it is carried out, the possible idiosyncrasies among peers, and the effort that is put into it. In MOOCs also occur other
critical aspects, such as language barriers, cultural differences and large differences in the student’s involvement (Weld et al., 2012). However, crowdsourcing is a valuable resource also in this area, enabling the development of probabilistic models that can validate peer-assessment processes. Coursera has experienced a statistical model that uses the assessment of only four classmates to grade a student’s submissions. An analysis of Piech’s work and his colleagues (Piech et al., 2013) attests the validity of the implemented methodology. To involve students in the peer-assessment process it was communicated that with the evaluation of five classmates assignments, each student would have obtained his own assessment. Among these, there were few assignments produced and evaluated by the teachers’ staff, unrecognizable for students. These assignments cover the entire grading scale and are assigned to a large students’ sample generated by using variables on previous activities that indicate their prior engagement, proficiency and previous reliability. Other variables come into play in the process of peer-assessment, even recursively, to take into account for each student the time spent for grading, the grade of evaluators, and of the evaluated people. In this way a peer-grading network is generated, allowing the estimate of the reliability of each student and the application of models to compensate idiosyncrasies and determine who grade whom. The results have attested the high statistical reliability of the model and have demonstrated that even in MOOCs with tens of thousands of students it is possible to use crowdsourcing to provide a reliable and accurate assessment on open-ended assignments with an acceptable workload distributed among students.

3.3 Career Services

The analysis of the data to make correlations between the various activities carried out by the students is proving to be very promising also in the context of job placement. For instance, the correlation between the data relating to the discussion forums with those of the assessment has indicated as the former has been predictive for the academic success (Young, 2012). The learning analytics allows to identify soft-skills such as communication skills, the ability to work in team and the willingness to help that may be associated to specific job profiles, useful to employers. Beyond the issues related to privacy, that dramatically emerge, there is no doubt of the importance of this aspect of personalization, which may become a model of income for MOOCs as attested by the agreements by Udacity and Coursera with some major companies.

Conclusion

While courses with hundreds or thousands of students bring into crisis the learning action within traditional universities, the participation of tens or hundreds of thousands of students in MOOCs generates new strategies to improve the learning processes. More than cost reduction or democratization of education, the possibility of “involve the crowds” may become the disruptive factor of MOOCs. Their success undermines the widespread opinion that considers online
learning impersonal, standardized and of little value, fielding strategies that do not reproduce and are not reproducible in traditional contexts.

It’s too early to understand whether MOOCs can be only a marketing strategy for those universities which are promoting them, or if they can be a real competitive challenge. In any case it’s reasonable to expect some development in the field of globalization of learning contexts. An interesting challenge would be to involve the crowd to generate knowledge, rather than to spread predefined content by lecturers, recovering the original aim of connectivist MOOCs (Downes, 2008; Siemens, 2008). Other important developments may come from MOOCs “independents” favored by free access providers that might find in the global interconnection and in crowdsourcing new mechanisms of social reputation. All of this represents an exciting field of research that promises developments.

References


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