Proceedings della Multiconferenza EM&M ITALIA

UNIVERSITÀ DEGLI STUDI DI GENOVA

Progress to work

Contesti, processi educativi e mediazioni tecnologiche

EXTENDED ABSTRACTS DELLA MULTICONFERENZA EMEM ITALIA 2017

Bolzano, 30-31 agosto, 1 settembre 2017

a cura di
MARINA RUI

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Designing MOOCs for teacher training according to their needs and disciplinary topics

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Abstract

This work illustrates the design path followed in the creation of two MOOCs realized in order to develop flexible and user-friendly products suitable to specific disciplinary contexts. There is a tight link between users learning mode and means used in the creation, distribution and enjoyment of training contents. The "SMART" project, “Science and Mathematics, Advanced Research for Good Teaching”, launched under the Erasmus + Action 2 (Strategic Partnership), involved the development of two MOOCs in the Mathematics and in Science for teacher training. The didactic methodology adopted and the contents were shared with transnational partnership. In the realization of the courses the difficulties of teachers in the use of new technologies and the link of the taxonomy of the course with the specific disciplinary content were taken into account. The MOOCs design began analyzing the training needs of teachers, on one hand, and the specific disciplinary topics on which to construct the courses, on the other hand. The teachers training needs gave us information on the competencies to develop and how these competences should be self-evaluated. The methodology used in the course was “Problem Posing and Solving” for Mathematics and P&PBL (Project & Problem-based Learning) for Physics and Science.

Keywords
Laboratory didactic, P&PBL methodology, Problem Posing and Solving, Self-evaluation in MOOC, Teacher training platform.

Introduction: the SMART project

In 2006, the EU member states developed the list of 'key competences for all' as part of their lifelong learning strategies and 'Key competences for Lifelong Learning – A European Reference Framework' was approved as Recommendation of the European Parliament and the Council (EU Parliament 2006). It defines the well-known set of eight key competencies and describes the essential knowledge, skills and attitudes related to each of these. The member states adopted the European Recommendation and introduced the notion of Competencies-Based Education. As result of this teachers are constantly told that they should incorporate competencies in their teaching. In this context SMART Project – Science and Mathematics Advanced Research in good Teaching (http://smartpps.carloanti.it/) – developed two MOOCs for helping teachers in their teaching (Brancaccio et Al., 2015). The Project took place from in September 2014 to november 2016, from a partnership of schools, universities and ministerial institutions which includes: Italy (Accademia delle Scienze di Torino, Direzione Generale per gli Ordinamenti Scolastici e la Valutazione del Sistema Nazionale di Istruzione, ISS Carlo Anti, Risorse in Crescita, Università degli Studi Roma Tre, Università di Torino), Hungary (Pecsi Radnoti Miklos Kozgazdasagi Szakkozepiskola), Germany (St. Thomas-Gymnasium), Sweden (Chalmers Tekniska Hoegskola AB) and the Netherlands (Tecnische Universiteit Delft).

The principal aims of the Project were the following:

- to improve the professional teachers' competences and to support innovation in the teachers' training through innovative practices based on the new computer and multimedia technologies;
- to provide tools and methodologies to facilitate the acquisition of mathematical competence and basic competences in science and technology through discussion and sharing with European partners and by introducing advanced technological tools to support teaching and learning;

An European community of practice cooperated in the design of two MOOCs for teacher training starting from the analysis of the needs of Mathematics and Science teachers of the involved countries and according to the EU key competencies framework. The two open on line courses are *Mathematical Modelling* for Math teachers and *Observing, Measuring and Modelling in Science* for Teachers of Physics and Science. All the material was experimented with the students of the schools of the Project and the two MOOCs are available at the address: http://opensmart.miurprogettopps.unito.it/

The teacher needs

The starting point of SMART was the discussion about the educational needs of teachers of Math, Physics and Science in order to define common educational models and possible paths of intervention accordingly. Each partner trough a questionnaire or using national surveys already available presented a series of data that was analyzed. For instance in Italy a questionnaire was administered to verify the status both of the perception that teachers have of their teaching practice, and of the quantity and quality of activities practiced in the previous two years for their own professional development and to investigate the areas of interest that the teachers had (Barana et al., 2017). From the 669 answers of teachers of Scientific subjects it emerged that they were generally aware that their teaching had to be innovated; in particular, Maths teachers felt that their lessons meet their students' interests less than their colleagues of other subjects (in a Likert scale from 1 to 5 the average value is 3.3 for Maths teachers against 3.5 of other subjects). There was an analogue difference also in the use of learning technologies (average: 3.5 for Maths teachers against 3.8 for other disciplines). Only 9% acknowledged to use a traditional teaching style, even though 71% defined their methodology still partly traditional. About 7% disagreed with the choice of reducing the quantity of specific Mathematical topics in the curriculum in favor of cross-crossing activities, problem solving and applications, however, only 52% totally agreed with this choice. About 65% had spent from 5 to 20 days in the previous 2 years in training activities, and 30% more than 20 days; among the most common topics, new methodologies and ICT stood out. The use of innovative methodologies and the preparation of multimedia and online learning materials stood out also among the desired object of professional development. The favorite training form was training courses/seminars. In conclusion, the portrait that emerged from the results is that of teachers quite open to innovation, aware of their need of renewing their instructional practices, but still partly tied to traditional teaching styles. For the analysis of teachers' needs of other countries, not very different from the ones of the Italian, national reports were used, that were already available

Topics and Competences framework

The second step in order to develop the open on line courses was the identification of pedagogical and disciplinary topics. This was based on the results of analysis of training and educational needs of Italian Mathematics and Science teachers compared with training needs in the other countries involved in the project and according to the specification of the OECD (Organisation for Economic Co-operation and Development) (Talis Survey, 2016). Acting on the professional competences of teachers leads to the direct consequence of improving the students' competences and therefore to a general positive effect on the school system.

In order to be effective, the Mathematics and Science teachers need to have good knowledge of their subject, good competence on how to teach it and the necessary flexibility to adapt their methods to all students' training needs. However, it is very difficult and expensive to reach a great number of teachers to refresh their competences. An effective method is to improve the cooperation between them and the sharing of their best practices through web platforms, social networking sites and other online resources. The project group worked on the definition of educational models to be shared at a European level for the training of teachers through the development of innovative didactic materials. These materials will help supporting teachers' professional competences and innovation in the initial and in-service training system but also developing competences, awareness and a constructive attitude in students. The courses contain different modules based on the adoption of innovative technologies like an Advanced Computing Environment (ACE) like Maple and an automatic Assessment System (ASS) like Maple T.A. They are aimed to a teaching which supports the teachers' work and students' learning with a constant formative assessment, but also projected to verify the acquisition of mathematical and scientific competences. The modules are based on learning objects, LOs (Wiley, 2001), freely accessible resources like simple text documents, 2D or 3D images, video clips, Java applets or other objects which can be used for the online learning (Crispiani and Rossi, 2006). A lot of lessons or didactic units can be implemented starting from the object itself; more didactic units make up the course modules. Problems with self-evaluation test and experiments accompanying the modules have a standard format, using ACE and being learning objects themselves.

Didactic methodologies adopted in MOOCs

The students have a really strong view of science as something which is reserved to specialists, who work in laboratories equipped with sophisticated and costly instrument, and they see the science world as a world apart, distant and mysterious indeed. This idea, along with the teaching model mostly used in the schools, pushes a great number of students away from science, not only in the sense that they won't follow academic studies of a scientific kind or won't look for profession in the scientific sector. An analogous problem is present in Mathematics, because the students are not able to move from a real problem situation to a mathematical model even if they are able to verify that the results of mathematical models are appropriate or not to the real problem situation (PISA 2012, 2014). For the two open on line courses all partners agreed on the adoption of "active" teaching strategies, which turn traditional ways of teaching upside down. That's even more true when, as in the times we are living, the changes have a great impact on the way knowledge is accessible and shared, that is, on school system “core business”. In the preparation of materials the “constructivist” (Jonassen, 1991) approach was chosen that is knowledge is not transmitted, it gets built up, thanks to the “necessity” to solve a problem, this is the principal characteristic of PP&S methodology. Teacher is thought as a guide, a facilitator, a movie director who, in the last phase of work, gives a formal structure and organization to knowledge, building a coherent framework. For the MOOC for teacher of Physics and Science P&PBL (Project & Problem-based Learning) methodology was adopted (Barell, 2006). It is founded, principally, on “Lab teaching” and starts from the “learning environment”: this is a wide-sense “environment”, in terms of a place, a time, a relationship among teacher and pupils, a set of tools, an interface with the world outside. Many teachers have great troubles taking this approach, even though they’re convinced it’s an effective one. On the other hand, they complain the lack of a “toolbox” to use in designing and setting up laboratorial learning experiences. Textbooks are still written with the old teaching model in mind. SMART project takes move from these considerations, from these needs, projecting them on an European context. For the MOOC for teacher of Mathematics SMART, instead, has tried to create a kind of MOOC using the Problem Posing and Solving methodology. The material proposed starts from a problem, that the teacher can be extend, change, personalize depending on the specific conditions and classes, and can also be a template for building new learning units. Last but not least, MOOCs are in English: this means that foreign language competences are immediately involved on one hand, and the materials can also be used within a CLIL path, on the other. All the contents are licensed under Creative Commons Attribution-ShareAlike 4.0 International License. We are sure that by diffusing this proposal within the professional teacher communities, the production of more material and enriching of the existing materials can be stimulated, as has happened in Italy for the LS-OSA of Science teachers, http://ls-osa.uniroma3.it, and PP&S networks of Mathematical teachers, www.progettopps.it, (Brancaccio et Al, 2015).

Structure of the formative paths and self evaluation

The structure of the formative path of the two MOOCs was designed in order to help teachers in using learning objectives related to key competencies to guide their teaching, accessing and sharing educational resources in the CBE spirit and accessing and sharing best practices.

For the Mathematical Modelling course all partners agreed that, according to teachers need, to have clear guidelines, access to appropriate tools and materials and exemplars of effective practice and ICT should help both the technical and pedagogical aspects in depth. For this reason a great emphasis to interactive activities and to open-ended problems and challenges was given. The course is broadly divided in two parts: the first one is for teachers' self-training on innovative computer and multimedia technologies; the second one contains learning materials that can be used in their classroom. In order to reach a more effective self-paced online courses' development learning materials are linked to materials for self–training. The materials are divided in three main typologies: Learning Materials (Maple Worksheet), Automatic-evaluation Materials (Maple T.A. Assignments) and Descriptions (Required in advances, Contents, Abilities, Competences, Key ideas). All of them are grouped into 4 main "topics" (or Content Areas), namely Quantity, Space and Shape, Change and Relations, Uncertainty. For each topic teachers can find examples of problems completely solved in the worksheet and a related assignment. For each of them they can consult a description that help to understand how to use in their teaching. Teachers that attend the online course are 1) introduced to the methodologies and the expected results of the online course, 2) trained on VLE, ACE and AAS, 3) invited to use the learning materials in their classrooms and to give feedback. In each module there are questionnaires in order to allow teachers to self-evaluate the competences gained attending the course and in order to allow them to give us useful feedback.

The Science course contains interdisciplinary practical activities designed to highlight the interconnections between the various disciplines: Physics, Chemistry, Biology and Earth Sciences. The key to the scientific method lies in observing phenomena, propose explanatory hypotheses to be experimentally verified or falsified through a critical analysis of data and results. Sometimes, due to lack of time and resources, this path is short-circuited in didactic practice, reducing to the experimental activities to a simple checking of laws and values of constants. Therefore the purpose of the activities presented in the Science course is to focus on observe events, describes models and hypotheses and critical review them. These aspects involves not only the knowledge of the physical laws, but also stimulate creativity and exploit the students' experience by encouraging intuition and reasoning by analogies. To stimulate the learner's intuition and experience, relatively simple activities were selected, that can be easily realized using simply obtainable materials and instruments (poor laboratory). This is an important aspect that in practice demonstrates the effectiveness of the scientific method for interpreting phenomena and aspects of common daily life, and especially outside of a didactic laboratory. The presented activities are organized in homogeneous paths but are modular and can be used either individually or combined at will, so that teachers can adapt and insert in their teaching paths. Activities are proposed in the form of tabs containing a first care for sake of easy consultation containing an abstract of the activities, the necessary materials and instrumentation, the prerequisites and objectives in terms of knowledge and skills. It follows a more detailed description of the various phases: main set-up, measurement, analysis and interpretation of the data, highlighting possible discussion topics, possible problems, and misconceptions. In many cases, electronic spreadsheets are provided to automate and simplify the data analysis procedures, leaving more room for discussion and interpretation of results. There are four sections. The first (Methods in science) approaches general methodological aspects ranging from laboratory teaching methodology, to the difference between inductive or deductive reasoning in the formulation of hypotheses and laws. It addresses the problem of measuring and dealing with measurement uncertainties and practical examples in the sciences. So they follow three thematic sections: a training path of optics, based on practical examples of poor laboratory, ranging from geometric optics (reflection, refraction, lenses and mirrors) to physical optics (interference and diffraction). A SeismoBox-based earthquake training route allowing to experimentally investigate the origin, nature and effects of earthquakes; an interdisciplinary section on Water, illustrating the role of water in nature, especially related to geo-sciences. Finally a section focused on Energy: from conservation law in mechanics, to bio-chemical energy presenting the electric energy produced by batteries, measuring the energy contained in foods (calories) and revealing ho photosynthesis works.

Results and discussion

Up to now the users of the two MOOCs are 425. This number could seem not too high but if we think on the audience interested in and on the fact that we just finished to prepare them at the end of November 2016 and no advertising was made the number is significant. The Figure 1 shows the accesses to the MOOCS in the last seven months from the beginning of Dicember 2016 to the end June 2017. Interesting are the answers of the users to the questionnaires of the Course Mathematical Modelling. For instance, in a scale from 1 to 5, they answer that they think that their students would appreciate the use of a VLE for a value 3.4, that it would be useful to improve their motivation for a value 3.6, that it would be useful to improve their skills for a value 3.6 and that the use of a VLE would contribute to improve didactic action for a value 3.7. The participants declare to be interested in the use of an ACE in the class because they think their students would appreciate the use of an ACE for a value 3.9, that it would be useful to improve their motivation for a value 4.0, it would be useful to improve their skills for 4.1 and that the use of an ACE would contribute to improve didactic action for 4.1.

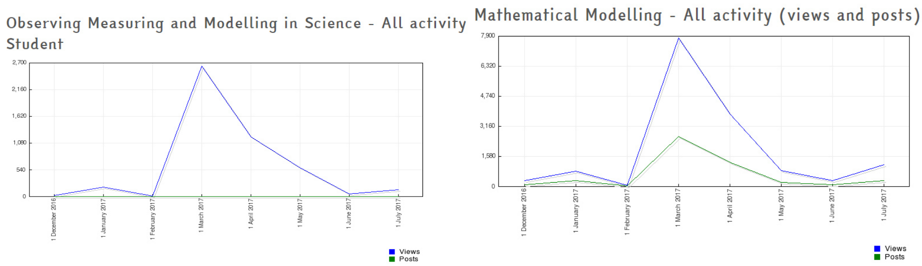

Figura 1 – Accesses to the MOOCs from 1-12-2016 to 1-07-2017

Similar answer to the question if they are interested in the use of automatically graded assignments with their class. They think their students would appreciate the use of an AAS for a value 3.9, that it would be useful to improve their motivation for a value 3.8, it would be useful to improve their skills for 3.9 and that the use of an ACE would contribute to improve didactic action for 4.0. In the questionnaire in which we ask them to rate the OOCs they gave a value of 4.5 for clearness of the structure of the course and 4.4 to the usefulness. They found them effective to improve the students' motivation, creative thinking and versatility in the search for solutions. 62% of them declare to have used learning materials with their students especially problems.

Conclusions

Several initiatives are in program in order to give more visibility to the two open on line courses and to obtain that many teachers can know and use it. For instance we are studying the simplest way to share the modules on international sites like Merlot (www.merlot.org) in which collection of open educational resources are available or we are suggesting them as practical ideas for CLIL activities to teachers of Mathematics, Physics and science. Moreover according to the feedback of the users we want to spend some more time in order to arrange the MOOCs and to improve the materials for a better use. Finally we can conclude that the methodologies that SMART proposes for teaching and learning could really be effective to educate and train students to become competitive and successful in work, society and life.

References

Barana, A., Brancaccio, A., Esposito, M., Fioravera, M., Marchisio, M., Pardini, C., Rabellino, S. (2017). Problem solving competence developed through a virtual learning environment in a European context. Could technology support learning efficiency? Proceedings of the 13th International Scientific Conference "eLearning and Software for Education", 1, 455-463. Bucharest.

Barell J.F (2006). Problem based learning: an Inquired approach, 2nd edition.

Brancacccio A., Marchisio, M. Meneghini C., Pardini C. (2015). Matematica E Scienze piu' SMART per l'apprendimento. Atti Didamatica Genova 2015, ISBN 978-88-98091-38-6.

Brancaccio, A., Demartini, C., Marchisio, M., Palumbo, C., Pardini, C., Patrucco, A., Zich, R. (2015). Problem Posing and Solving: Strategic Italian Key Action to Enhance Teaching and Learning of Mathematics and Informatics in High School. Proceedings of COMPSAC Symposium on Computer Education and Learning Technologies (CELT). Taichung.

Crispiani P., Rossi P. (2006). E-Learning. Formazione, modelli, proposte. Armando editore. Roma.

EU Parliament. (2006). Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning. Offi cial Jour. of the European Union 06.05.2008.

Jonassen, D.H. (1991). Objectism vs. constructivism: Do we need a new philosophical paradigm shift? Educational Technology: Research & Development, 39 (3).

PISA 2012 (2014). Results: What Students Know and Can Do. Volume I, Revised edition, February 2014.

Talis Survey (2016). Supporting Teacher Professionalism: Insights from TALIS 2013, OECD.

Wiley D. A. (2001). Connecting learning object to instructional design theory: a definition, a metaphor and a taxonomy, Utah State university, Digital Environments Research Group, The Edumetric Institute.

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