Designing PhysicIdea! MOOC: Challenges on teacher education

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ABSTRACT

Massive Open Online Courses provides massive scale education supporting the transfer of knowledge and the potential of collaborative and social learning. In addition, can be a cost and resource effective means to complement the traditional methods of professional development of teachers. Teacher Professional Development has become a major policy priority within education systems worldwide. Keeping teachers professionally up-to-date and providing them professional development opportunities on continuing basis is a big challenge. Learning Analytics aims of understanding and optimizing learning through data provided from learner's action in a digital environment. Teaching strategies that take into account students' previous perceptions are fundamental for science education. Students of all levels daily deal with concepts like light and color and appear alternative ideas about these concepts. This paper discusses the challenges of Teacher Professional Development, reflects upon promises of using Massive Open Online Courses for Teacher Professional Development; details initiatives and experiences of using Massive Open Online Courses for Teacher Professional Development, and suggests actions for promoting the use of Massive Open Online Courses for Teacher Professional Development. Finally, proposes the integration of digital learning environments into a MOOC that offers techniques for the detection of future teachers' ideas about the concepts of light and color.

KEYWORDS

Teacher Professional Development, MOOCs, Learning Analytics, ideas

RÉSUMÉ

Massive Cours en ligne ouverts (MOOCs) offrent une formation à grande échelle favorisant le transfert des connaissances et le potentiel de l'apprentissage collaboratif et social. De plus, ils peuvent être un moyen efficace, en termes de coût et de ressources, pour compléter les méthodes traditionnelles de développement professionnel des enseignants. Le développement professionnel des enseignants est devenu une priorité politique majeure dans les systèmes éducatifs du monde entier. Garder les enseignants professionnels et leur fournir des opportunités de développement professionnel sur une base continue est un grand défi. Learning Analytics a pour objectif de comprendre et d'optimiser l'apprentissage grâce aux données fournies par les actions des apprenants dans un environnement numérique. Les stratégies d'enseignement qui prennent en compte les perceptions antérieures des élèves sont fondamentales pour l'enseignement des sciences. Cet article présente les défis du développement professionnel des enseignants, reflète sur des promesses d'utilisation des MOOCS pour le développement professionnel des enseignants, détaille les initiatives et expériences d'utilisation des MOOCs pour le développement professionnel des enseignants, et *suggère des actions pour la promotion de l'utilisation de ces cours dans le développement professionnel des enseignants. Enfin, cet article propose l'intégration des environnements numériques d'apprentissage dans un MOOC qui offre des techniques pour la détection des idées de futurs enseignants sur les concepts de lumière et de couleur.*

MOTS-CLÉS
Développement professionnel des enseignants, MOOCs, Learning Analytics, Idées

INTRODUCTION

Higher education aims to engender self-regulated learners due to the need for lifelong learning. Massive Open Online Courses (MOOCs) nowadays considered an engaging method for teachers to gain greater expertise and new skills in the context of professional development. In MOOCs the majority of registrants are professionals enrolling into the courses for professional development, personal interest and develop their own knowledge suggesting MOOCs as an alternative method for Teacher Professional Development (TPD) (Vivian, Falkenr & Falkner, 2014). In addition, MOOCs offers massive participation that generates enormous data from students interactions with learning materials. Higher Education Institutions due to support and understand students learning are developing and implementing learning analytics systems. Learning Analytics (LA) aims to offer highly adaptable and personalized learning environments in order to help to foster students skills in managing, monitoring, and reflecting their own learning (Schumacher & Ifenthaler, 2018). Knowing students prior knowledge is crucial for science education in order to construct new knowledge. Teachers have to adapt learning and teaching techniques taking into account students ideas using them as the starting point of the learning process. To do this, however, teachers themselves must be aware of their own ideas.
In the current study, we propose the PhysicIdea MOOC where a pedagogical framework within a technological one and the integration of a learning analytics system will monitor the cooperative work. The aim of this paper is to provide and study the adoption of MOOCs in teacher education as an alternative tool for TPD in the field of science education and especially into the concepts of light and color. The main questions of this paper are how MOOCs could enrich learning experiences in TPD, how MOOCs potential could enrich learning experiences in science education and why the detection of misconceptions is a subject that is in harmony with the environment of a MOOC.

MOOCs FOR TEACHER PROFESSIONAL DEVELOPMENT

TPD seems to be an appropriate approach to enhancing teachers capacities and engagement, as it includes elements aimed at changing skills, knowledge, and experience gained both formally and informally, beyond the initial education (Misra, 2018). TPD aims to develop, implement and share teachers practices in order to promote learning and development of their personal knowledge, achieve better skills and values and to decide and implement best practices so they can educate their students more effectively (Earley & Bubb, 2004). TPD activities include critique and co-construction of innovative ideas, implementation of innovative strategies followed by observation and documentation of the effects of innovation on students learning. In addition, they provide reflection on and reconstruction of what it means to teach and to learn (Butler, Lauscher, Jarvis-Selinger, & Beckingham, 2004). All of these foster self-regulated learning, which is the ability to take responsibility for one’s own learning and teach autonomously (Zimmerman, 1990).

MOOCs have the potential to provide open and massive scale education, supporting the transfer of knowledge and the potential of collaborative and social learning through forums, blogs and quizzes (Yousef et al., 2015). Participating in MOOCs can help to develop certain teaching, digital, and academic skills (Urrutia, Fielding & White, 2016). MOOCs can promote involvement, engagement, and creativity of their students through their digital content. In addition, personalization in MOOCs offers learners to shape their own personal experience by customizing their preferences.

MOOCs are currently emerging and receiving great interest in various fields, considers as a new technological tool TPD (Vivian et al., 2014). They promise to support TPD by providing accessible, flexible and fast-track completion of certified courses (Kumari, 2016). MOOCs for TPD should include authentic work, tasks that require the application of the skills or knowledge learned in real situations (Hodges, Lowenthal & Grant, 2016). Teachers control responsible for their learning either adopting self-regulated practices or collaborating ones in order to achieve their learning outcomes. In addition, teachers uses material resources and can seek support and collaboration with their peers (Koukis & Jimoyiannis, 2017). Using MOOCs for TPD offers ways for a teacher to observe others teach online, join communities conversations about topics of their interests, re-live students experience, learn new things under a constructive approach and find well-chosen resources on a topic of interest in the context of lifelong learning.

LEARNING ANALYTICS IN MOOCs

MOOCs can generate a large amount of data from learners who leave traces behind such as mouse clicks, forum activity, quizzes, connection frequency, and time spent on watching a video. LA aims to optimize learning by studying the dynamic processes that occur during this process. They define as "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Siemens & Gasevic, 2012). LA uses for monitoring and analysis, prediction and intervention, tutoring and mentoring, adaptation, personalization, recommendation and reflection (Atif, Richards, Bilgin & Marrone, 2013; Chatti, Dyckhoff, Schroeder & Thüs, 2012). The process includes searching, filtering, mining and visualizing data in order to retrieve meaningful information (Khalil & Ebner, 2016). LA can interpret this data and help researchers from various disciplines of science to intervene directly in the success of students.

LA techniques in MOOCs use static and dynamic information about learners and learning environments. Based on specific modules from learners' data on previous activities, researchers predict when a learner will drop out of a course or a learner at-risk. Video lectures analytics and activity in discussion forums also used to predict learners performance. Previous actions through LA creates in MOOCs dashboards in order to support awareness, reflection, and sense-making for learners (Verbert et al., 2014). Data analysis through their visualization into plots gives researchers the opportunity to reveal the pattern and provide feedback and reflection to MOOC participants (Khalil & Ebner, 2016). LA also used to benchmark courses, videos, and assignments in order to identify learners' learning difficulties in the context of a constructive feedback.

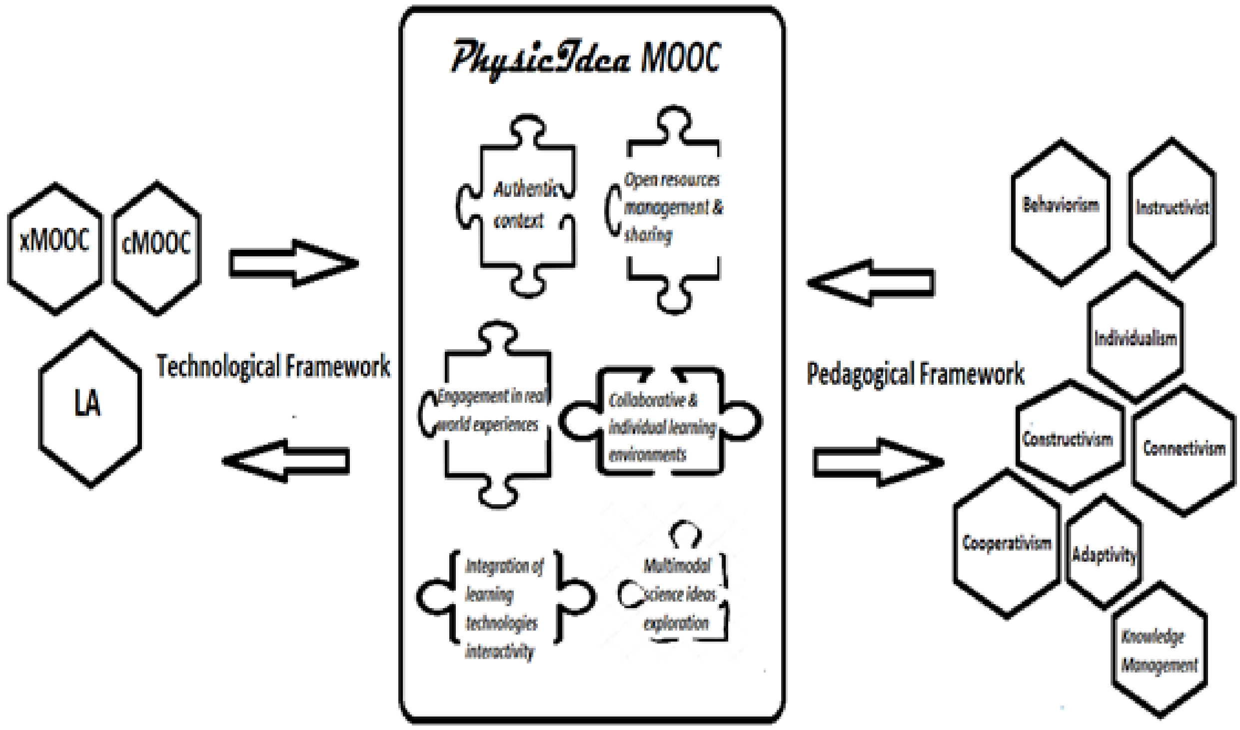
THE PsysicIdea! MOOC FOR TEACHER PROFESSIONAL DEVELOPMENT

Investigating students' prior knowledge and experiences helps teachers to organize appropriate didactic interventions to facilitate conceptual change when students pre-existing perceptions differ significantly from scientific knowledge. Pre-existing and new ideas will interact, and in all likelihood, conflict, which will lead to the reconstruction of student knowledge or even the change of some concepts (Hewson & Hewson, 1987). One of the subjects in the field of Physics in which students of all age groups have many misinterpretations is Geometric Optics. Students seem to have difficulty interpreting light-related phenomena in spite of their knowledge, while at the same time showing firm resistance to efforts aimed at changing their misinterpretation and understanding of natural phenomena (Blizak & Chafiqi, 2014).

The proposed PhysicIdea! MOOC is designed as a hybrid MOOC that seem to achieve higher rate of completion compared to other types of MOOCs and it is widely accepted by participants (Fidalgo-Blanco, Sein-Echaluce & García-Peñalvo, 2016). The methodological model is based on the adaptivity learning (in activities type x and c) and the integration and management of knowledge generated during activities type x and c. The technological framework of the proposed MOOC is based on the integration of formal learning (xMOOC) with the informal learning (cMOOC) allowing autonomous learning during and after the course. It is based on a learning ecosystem composed by a Learning Management System (LMS), Learning Analytics and Web 2.0 tools for knowledge management and gamification. Moodle LMS (version 3.6) is friendly enough for both instructional designers and participants fulfill the accessibility standards offering mobile access. In addition, it includes increasingly useful tools, SCORM compliance and external plugins complement to the basic installation.

The pedagogy of PhysicIdea! MOOC aligned with the technology and this technological framework allows adaptivity (personalized training), massive cooperative work, multimodal science ideas exploration, engagement in real world experiences, integration of learning technologies interactivity, authentic context, open resources management and sharing and finally collaborative & individual learning environments. All this makes it possible to carry out the methodological requirements, putting technology at the service of the methodology (Figure 1).

FIGURE 1



PhysicIdea! MOOC framework

The core dimension of the PhysicIdea! MOOC is structured with respect to the content to be covered, the course schedule, the educational material and participants learning activities. Resources and activities are organised with a sequential structure of modules and sections providing self-regulated learning to the participant, which leads to the reduction of the attrition caused by disorientation (Littlejohn, Hood, Milligan & Mustain, 2016). The other equally important dimension was expected to be dynamically shaped around participants interaction and collaboration aiming at the co-creation of artefacts and, ultimately, social knowledge construction. Simultaneously, it incorporates elements that bring the structured course closer to the social network, where the new training service is directed.

A key feature in the design of the PhysicIdea! MOOC is the exploitation of the detection of existing ideas as a tool for approaching the concepts of light and color as a basic feature of everyday life, of many modern technologies, and the main tool in many sciences. In particular, feature teachers will approach the concepts under study through different detection techniques and actions by which they will seek out and study their ideas for light and color, compare and explore them through alternative perceptions of their fellow students, perceptions of young and older children, scientific literature and diverse educational environments. In addition, they will explore the wide range of relevant teaching activities on the color concept, color theme in the environment, and the cultural dimension of color perception.

DISCUSSION

This paper proposes the adoption of MOOCs as an effective alternative to traditional teacher training and professional development programs. We propose a hybrid MOOC where future teachers will study and interpret with the concepts of light and color. PhysicIdea! MOOC technological framework is based on the adaptation of the learning strategy for formal and informal activities to the profiles and preferences of the participants, the management of the knowledge generated through both types of activities and their integration in the learning space of an LMS. In addition, it integrates a learning analytics system as a research interactive tool, in order to study the traces of participants learning pathways. The choice of sensing ideas as an educational tool in the specific MOOC is that in science education, children, young people and adults alternative ideas about the world surrounding them, have a dominant and distinct role. These are the ideas that begin to form through the contexts of informal learning before even children join formal education structures and often last up to adulthood. The choice of ideas as a key element in the educational design of the current MOOC is not limited to teaching objectives of understanding the phenomenon by trainees. The main objective is for trainees to discover and explore the alternative ideas at the scientific field of science education and the context in which ideas for the natural environment are shaped. To study the versatility of ideas but at the same time to find alternative ideas as a tool for understanding the cognitive obstacles of children and the insidious theories for the interpretation of natural phenomena.

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