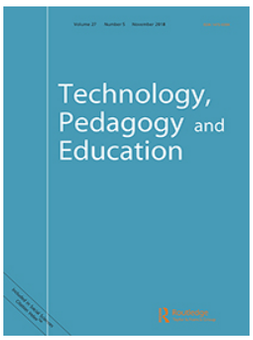

Technology, Pedagogy and Education

ISSN: 1475-939X (Print) 1747-5139 (Online) Journal homepage: https://www.tandfonline.com/loi/rtpe20

Who is taking MOOCs for teachers' professional development on the use of ICT? A cross-sectional study from Spain

Jonatan Castaño-Muñoz, Marco Kalz, Karel Kreijns & Yves Punie

To cite this article: Jonatan Castaño-Muñoz, Marco Kalz, Karel Kreijns & Yves Punie (2018) Who is taking MOOCs for teachers' professional development on the use of ICT? A cross-sectional study from Spain, Technology, Pedagogy and Education, 27:5, 607-624, DOI: 10.1080/1475939X.2018.1528997

To link to this article: https://doi.org/10.1080/1475939X.2018.1528997

Published online: 19 Oct 2018.

TECHNOLOGY, PEDAGOGY AND EDUCATION
2018, VOL. 27, NO. 5, 607–624
https://doi.org/10.1080/1475939X.2018.1528997

Routledge
Taylor & Francis Group

Who is taking MOOCs for teachers' professional development on the use of ICT? A cross-sectional study from Spain

Jonatan Castaño-Muñoz[a], Marco Kalz[b,c], Karel Kreijns[d] and Yves Punie[a]

[a]Joint Research Centre, European Commission, Seville, Spain; [b]Technology-Enhanced Learning, Heidelberg University of Education, Heidelberg, Germany; [c]Faculty Management, Science and Technology, Open University of the Netherlands, Heerlen, the Netherlands; [d]Welten Institute, Open University of the Netherlands, Heerlen, the Netherlands

ABSTRACT

Research on the use of Massive Open Online Courses (MOOCs) for teacher professional development (TPD) and the characteristics of their participants is scarce. This article presents a case of a MOOC initiative supported by the Spanish Ministry of Education aiming at teachers' professional development on the use of ICT for teaching and learning. The analysis is focused on (a) the sociodemographic and school characteristics of the teachers participating in MOOCs; (b) their experience and beliefs about lifelong learning; and (c) the relevance of MOOCs for their work. By contrasting the characteristics of the participants in this initiative with the characteristics of the whole population of teachers in Spain, and a sample of Spanish participants in MOOCs not aimed at TPD, the article sheds light on the specificities of the teachers who use this way of TPD. The results have implications for the design of programmes aimed to develop MOOCs for TPD.

ARTICLE HISTORY
Received 22 March 2017
Accepted 8 April 2018

KEYWORDS
Open education; Massive Open Online Courses; MOOCs; teacher training; professional development

Introduction

Lifelong learning is becoming more important for modern economies (Longworth, 2003). Owing to the speed of innovation, a constant update of knowledge and competences is needed to cope with the highly dynamic reality of present societies. UNESCO stated:

> The role of lifelong learning is critical in addressing global educational issues and challenges. Lifelong learning 'from cradle to grave' is a philosophy, a conceptual framework and an organising principle of all forms of education, based on inclusive, emancipatory, humanistic and democratic values; it is all-encompassing and integral to the vision of a knowledge-based society. We reaffirm the four pillars of learning as recommended by the International Commission on Education for the Twenty-first Century, namely learning to know, learning to do, learning to be and learning to live together. (UNESCO, 2009, pp. 5–6)

The value of having a degree is becoming less important (Beaudry, Green, & Sand, 2016) and a continuous post-degree updating of skills has been signalled as a key element for productivity.

At the same time, high-quality teachers are considered a key element for effective educational systems. Hattie (2012, 2015) conducted a meta-analysis of nearly 1200 meta-analyses on 195 factors influencing learning and achievement. When ranking these influences according their effect sizes, he concluded that factors with the biggest impact were all pointing to the teacher. However, in many countries teachers are facing new challenges that can affect their capacity to provide education effectively (Organisation for Economic Co-operation and Development [OECD], 2017).

CONTACT Jonatan Castaño-Muñoz jonatan.castano-munoz@ec.europa.eu

This article has been republished with minor changes. These changes do not impact the academic content of the article.

These challenges range from the need to respond to the new characteristics of learners to greater pressure to implement innovative and more efficient methodologies and to transform teacher education into a research-based practice (Bauer & Prenzel, 2012). In this context, teacher professional development (TPD) is becoming crucial for enhancing teaching quality and facilitating teachers' adaptation to their new professional reality (Evers, Van der Heijden, Kreijns, & Vermeulen, 2016).

The use of information and communication technology (ICT) as a tool for responding to the challenges is one of the most sought-after topics regarding teacher training needs. According to the 2013 OECD TALIS survey data (OECD, 2014), the majority of teachers in Spain report that they need more professional training on the use of ICT for teaching and learning. Almost two-thirds stated that they had a moderate or high-level need for training in ICT for teaching and learning (65.5%) or in new technologies at the workplace (62.9%). Reports in the Netherlands and Belgium about ICT use in teaching support these findings (Pynoo, Kerckaert, Goeman, Elen, & van Braak, 2013; Voogt et al., 2014). Digital competence for teachers has also been highlighted as a policy priority in many EU countries (see the DigcompEdu JRC project: https://ec.europa.eu/jrc/en/digcompedu for more details) and the need for fostering teachers' digital competences is becoming more important in the policy agenda.

TPD can be provided in different ways: formal courses or workshops, peer learning within the school or in cooperation with other schools or informal events. Recently, several Massive Open Online Courses (MOOCs) on teaching skills have been added to this range of possibilities offering flexibility and more training possibilities to teachers. MOOCs are online courses without entrance requirements other than Internet access. Consequently, MOOCs are free for the learners and do not set a maximum number of participants. The lack of entrance requirements is an important feature when analysing the possibilities of MOOCs for teacher training because traditional teacher training courses tend to limit the number of participants and apply selection criteria (Kasch, Van Rosmalen, & Kalz, 2017). Moreover, when compared with other TPD options, MOOCs have higher dropout rates and are more often linked to informal types of certificates, which can be less recognised by formal accreditation systems.

Interestingly, there is evidence about the good acceptance of the MOOC format by teachers. An initial study of the large participant population of MOOCs offered by Harvard and the Massachusetts Institute of Technology between 2012 and 2014 showed that approximately 40% were past or present teachers (Ho et al., 2014). Data from the MOOCKnowledge project confirms this high participation rate of teachers in non-teacher training MOOCs in Spain (Castaño-Muñoz, Punie, & Inamorato dos Santos, 2016).

Despite this high potential, there is surprisingly little research that systematically analyses the characteristics of teachers participating in MOOCs specifically from the perspective of their professional development. Only a few studies are available to date and most of the available literature reports about the design and effects of a single MOOC for teachers.

Kleiman, Wolf, and Frye (2013) reported about a MOOC designed for professional development of teachers in the USA. The authors stressed the importance of this flexible way of training in times of decreasing resources for the formal education of teachers. Participants in these MOOCs were coming from district and school administration, school support and classroom teachers. Vivian, Falkner, and Falkner (2014) discussed the specific design and implementation process of a MOOC aimed at supporting teachers for a specific implementation of a new computing curriculum in Australia. Jobe, Östlund, and Svensson (2014) discussed the win–win situation that MOOCs for teacher professional development can create. Laurillard (2014) reported details about a low-cost MOOC designed for TPD. The study revealed that a study load of five hours per week would have led more participants to complete the course. A follow-up analysis of data from the same context as in the study by Ho et al. (2014) revealed that teachers in MOOCs are to a large extent interested in accreditation options for their participation (Seaton, Coleman, Daries, & Chuang, 2014, October 29). The study also showed that teachers are significantly more active in forum discussions in

MOOCs compared with the rest of the participant population. Laurillard (2016) introduced an explorative study about a professionalisation MOOC for teachers from emerging economies. While she reported that the actual reach of the MOOC was good, the group of teachers from emerging economies was underrepresented in the group of participants who completed the MOOC and completion rates were higher when the job status of the participants was also higher. Last but not least, Jobe et al. (2014) – but also other authors in this small sample of studies – concluded that more empirical and analytical research is needed to identify the potential success and hazards of MOOCs for TPD.

To contribute new knowledge about the use of MOOCs for TPD, we have conducted a study in the context of an initiative of the Spanish Ministry of Education. The Spanish Ministry of Education's National Institute for Educational Technology and Teacher Education (INTEF) has recently started an online initiative for teachers' professional development using MOOCs (see http://enlinea.intef.es/) with the goal to increase awareness and knowledge about the use of ICT for teaching and learning. In the context of the INTEF initiative, different MOOC formats have been offered. Besides a classical MOOC approach for teacher training (TTMOOCs), the concept of Nano-MOOCs (TTNOOCs) was explored. The NOOCs covered specific competence areas of the European Digital Competence Framework for Citizens 'Digcomp 2.0' (Vuorikari, Punie, Carretero, & van den Brande, 2016) adapted to teacher needs and were very flexible with an expected workload of three hours for each NOOC. However, the combination of several NOOCs would entail a greater workload and more in-depth training on digital competence. On the other hand, INTEF 'classical' MOOCs were six-week courses that required between three and a half and five hours a week of learner effort. All the courses except one (Open E-twinning) were offered in Spanish. INTEF MOOCs and NOOCs were open to everybody but explicitly targeted at teachers in primary and secondary education. In addition to videos, tests and course activities, the pedagogy of INTEF MOOCS and NOOCs is focused on fostering interaction among learners via social networks. Finally, in both cases INTEF offers digital badges to those who complete the courses.

In this article we report on the evaluation results of this sample of MOOCs provided to teachers in Spain. The five guiding research questions are as follows:

- RQ1: What are the characteristics of Spanish individuals participating in TTMOOCs and TTNOOCs on the use of ICT in education?
- RQ2: How do these characteristics compare with the characteristics of the whole Spanish teacher population?
- RQ3: How do these characteristics compare with the characteristics of Spanish learners participating in general MOOCs (not aimed at teacher training)?
- RQ4: Can TTMOOCs alleviate existing barriers to TPD in Spain?
- RQ5: What are the differences between short TTNOOCs and standard TTMOOCs?

In the study we focused on the analysis of (a) the sociodemographic and school characteristics of the teachers participating in MOOCs; (b) their experience and beliefs about lifelong learning; and (c) the relevance of MOOCs for their work.

The next section introduces the methods applied in the study followed by results and conclusions.

Method

Instruments

The instruments used in this research were part of the MOOCKnowledge questionnaire. The MOOCKnowledge initiative developed a set of standardised instruments to assess the perception of participants in European MOOCs and the impact of their participation across different MOOC

providers. The questionnaire was developed on the basis of the reasoned action approach by Ajzen and Fishbein (Fishbein & Ajzen, 2010) and self-determination theory (Deci & Ryan, 2000); it was focused on a number of distal, proximal and outcome variables. The basic version of the questionnaire used scales that were validated previously and scales that were piloted, adapted and validated throughout the development of the MOOCKnowledge project using Rasch methodology (Bond & Fox, 2015). The full theoretical framing and variables of the questionnaire are described in Kalz et al. (2015). To answer RQ4 and explore how MOOCs alleviate existing barriers to TPD in Spain, questions from the TALIS 2013 study related to professional development were added (OECD, 2014).

Measures and procedures

In order to address our research questions, we collected data using an online pre- and post-questionnaire on seven TTMOOCs and six TTNOOCs offered by INTEF. MOOCs covered different aspects of the use of ICT in education: how to use a platform aimed at fostering cross-country collaboration between teachers (E-twinning); how to use digital storytelling for learning; how to teach and assess the acquisition of digital competences in schools; how to implement digital gamification in the classroom for enhancing students' motivation; how to foster cooperative learning through digital technologies; and how to foster students' creativity and entrepreneurship. On the other hand, NOOCs were oriented to develop teachers' general digital competences.

The target group of the study were active Spanish participants in MOOCs (who had at least started learning activities). To reach this target group, we posted the survey as a part of the MOOC activities in the first week of the course to ensure that respondents had at least started the MOOC. As Evans, Baker, and Dee (2016) pointed out, response to MOOC pre-course surveys is usually associated with an active participation in the MOOCs. Consequently, after excluding non-Spanish participants from the analysis, this report refers only to a smaller group of the individuals enrolled in the MOOCs, namely the active Spanish participants.

To contrast the specific characteristics of active Spanish teachers in the TTMOOCs and TTNOOCs with those of the whole Spanish teacher population and with those other Spanish MOOC takers who participated in general MOOCs (i.e. not teacher-oriented MOOCs), we used additional data from:

- The wider primary and secondary teacher population in Spain using administrative data (N = 670,398) (Spanish Ministry of Education, 2016).
- A representative sample of the wider teacher population in Spain using national Spanish data from the TALIS survey in 2013 about barriers to and needs for continuous professional development (N = around 6030 for our questions of interest) (OECD, 2014).
- Data from Spanish participants in MOOCs who were not teachers. The data source was the MOOCKnowledge project pilot data covering three non-teacher training MOOCs on entrepreneurship, anxiety management and business intelligence (N = 1085) (Castaño-Muñoz, Kreijns, Kalz, & Punie, 2016).

Beyond the description of the TTMOOCs and TTNOOCs participant characteristics (RQ1), our research aimed to compare certain variables between different groups (RQ2, RQ3, RQ4 and RQ5). Consequently, in all cases, when differences were found, comparison tests were performed in order to assess whether these differences were significant. In the majority of the cases we performed two-tailed z-score tests for comparing proportions. In one case we used an independent t-test for mean comparison (see Figure 15).

Participants

The participants in this study were learners from seven INTEF TTMOOCs and six TTNOOCs. In total, 15,219 people enrolled (11,566 in TTMOOCs and 3653 in TTNOOCs), and 81% of them were teachers (82% in TTMOOCs and 77.7% in TTNOOCs). From these, 10,903 were Spanish citizens (8305 in TTMOOCs and 2598 in TTNOOCs) and 8758 of those were teachers (6725 in TTMOOCs and 2033 in TTNOOCs). This means that our study covered approximately a share of 1.31% of the total number of Spanish teachers (670,398 in the academic year 2015–16) who enrolled in one of our sample INTEF TTMOOCs or TTNOOCs. Owing to language proximity, participants from other countries were mostly based in Latin America. See Figure 1.

In order to allow the comparability needed to answer our research questions, in this study we focused only on Spanish participants. Including teachers and non-teachers, in total 1730 of the Spanish participants in INTEF MOOCS (21% of the total) and 756 of the Spanish participants in TTNOOCs (29% of the total) responded to the survey. Table 1 presents information about topics, total enrolment, total completion rates, enrolment from Spain and responses from Spain for each of the seven TTMOOCS and six TTNOOCS that provided data for this study. Our survey data revealed the following demographic profile: around 42 years old, female (62% in TTMOOCs and 56% in TTNOOCs), have a Bachelor's or Master's degree (82%) and are wage earners (80% in TTMOOCs and 79% in TTNOOCs). Finally, data from Table 1 show that the MOOCs' completion rate in INTEF MOOCs was around 5% while it was five times higher, around 25%, in the case of short nano-MOOCs.

Results

Profile of participants in INTEF's teacher training MOOCs

Age differences

Spanish participants aged between 40 and 49 years were overrepresented in INTEF's teacher training MOOCs compared with the general population of Spanish teachers. Differences in the participation rate of people aged between 40–49 years between TTMOOCS/TTNOOCS and Spanish teachers were significant: $z = 9.05$, $p < 0.01$ for TTMOOCs and $z = -6.245$, $p < 0.01$ for TTNOOCs. See Figure 2.

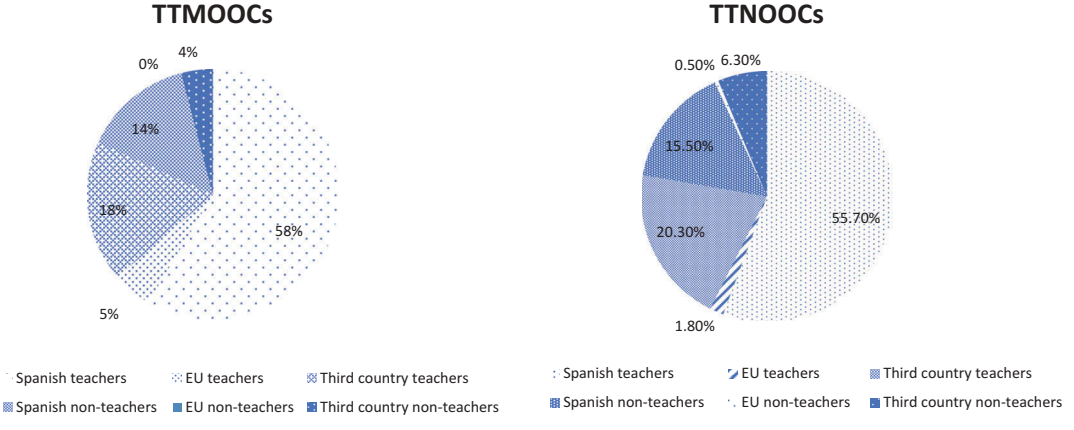

Figure 1. Participants in TTMOOCS and TTNOOCS. Percentage of teachers and non-teachers by nationality.

Table 1. Participants in TTMOOCS and TTNOOCS. Percentage of teachers and non-teachers by nationality.

TTMOOC FORMAT				
	Total enrolment	Total completion rate	Enrolment from Spain	Responses from Spain
Sense of Initiative and Entrepreneurship in the Classroom	1405	7.80%	868	129 (14.9%)
Open e-Twinning (2nd edition)	1512	2.06%	898	151 (16.8%)
Educational Use of Digital Storytelling	1099	5.37%	606	122 (20.1%)
Teaching and Assessing Digital Competence	1069	4.96%	635	137 (21.5%)
Gamification	2612	5.93%	2024	595 (29.4%)
Cooperative Learning	2910	6.56%	2458	451 (18.3%)
Open e-Twinning (3rd edition)	959	6.99%	816	135 (16.5%)
Total	**11,566**	**5.81%**	**8305**	**1720 (20.7%)**
TTNOOC FORMAT				
	Total enrolment	Total completion rate	Enrolment from Spain	Responses from Spain
Self-Protection on the Internet	792	27.53%	602	189 (31.4%)
Measures and Actions against Cyberbullying	624	20.19%	469	104 (22.1%)
Digital Communication	560	20.89%	385	150 (38.9%)
Health Protection and Ergonomics	305	23.93%	211	50 (23.7%)
Browsing, Searching and Filtering Information	631	27.73%	411	119 (28.9%)
Effective Information Management	741	27.13%	520	144 (27.7%)
Total	**3653**	**24.91%**	**2598**	**756 (29.1%)**

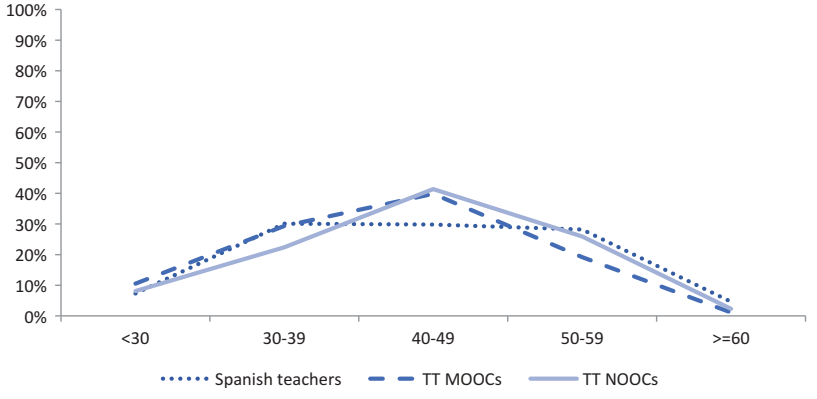

Figure 2. Age distribution.

Gender differences

While women constitute 72% of the teaching workforce in Spain, only 62% of participants (TTMOOCs) and 56% (TTNOOCs) of the survey respondents were female. These differences between the percentage of women participating in TTMOOCS/TTNOOCS and the percentage of women in the general population of Spanish teachers were significant: $z = 8.682$, $p < .01$ for TTMOOCs and $z = 8.80$, $p < .01$ for TTNOOCs. Interestingly the data also showed that a significantly higher percentage of women enrolled in TTMOOCs than in TTNOOCs ($z = 3.03$, $p < .01$). See Figure 3.

This difference can be explained by the low participation of female primary school teachers in INTEF's TTMOOCs and TTNOOCs. The percentage of female teachers in public primary schools in Spain was 81%, whereas women represented only 64% of primary school teachers enrolled in MOOCs and 57% in NOOCs. The differences between the percentage of female primary school teachers participating in TTMOOCS/TTNOOCS and the percentage of female primary school

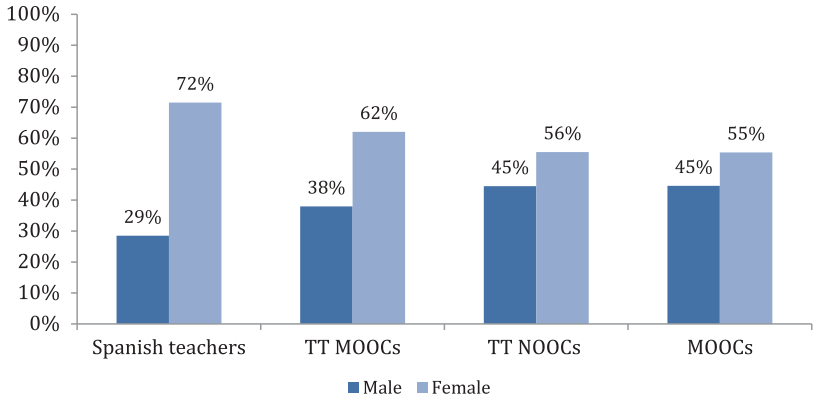

Figure 3. Gender distribution.

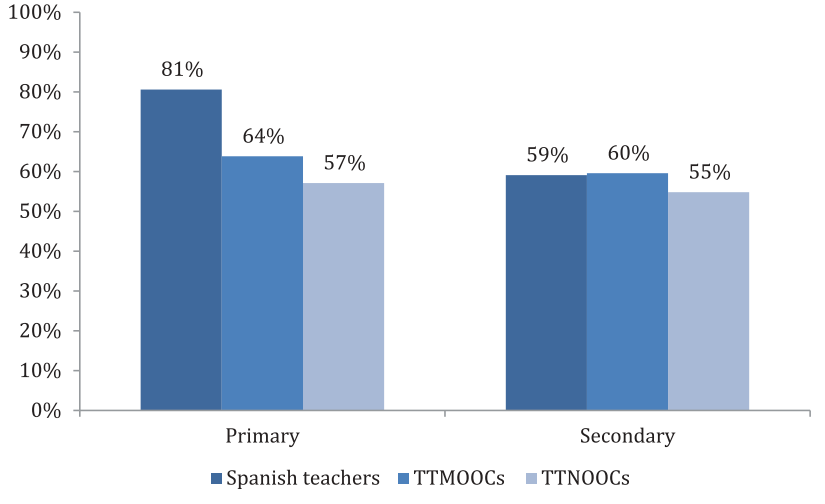

Figure 4. Percentage of female teachers by school level (excluding private schools).

teachers in the general population of Spanish teachers was significant: $z = 8.45$, $p < .01$ for TTMOOCs and $z = 7.815$, $p < .01$ for TTNOOCs. See Figure 4.

School type differences

In accordance with the finding that the percentage of female Spanish primary school teachers participating in TTMOOCS and TTNOOCs was lower than the percentage of females in the overall population of Spanish primary school teachers, we also expected that fewer Spanish teachers from primary schools participated in INTEF's TTMOOCs and TTNOOCs compared with the general population of Spanish teachers. Differences between the percentage of primary teachers participating in TTMOOCS/TTNOOCS and the percentage of primary teachers in the general population of Spanish teachers were significant: $z = 6.161$, $p < .01$ for TTMOOCs and $z = 7.010$, $p < .01$ for TTNOOCs. Primary school teachers represented 51% of the Spanish teacher population but only accounted for between 32% and 40% of the participants on these courses. Remarkably, our data also showed that, proportionally, teachers in vocational education (VET) and training were significantly more likely to participate in the courses offered. Differences between the percentage of VET teachers participating in TTMOOCS and TTNOOCS and the percentage of VET teachers in the general population of Spanish teachers were significant: $z = 3.059$, $p < .01$ for TTMOOCs and $z =$

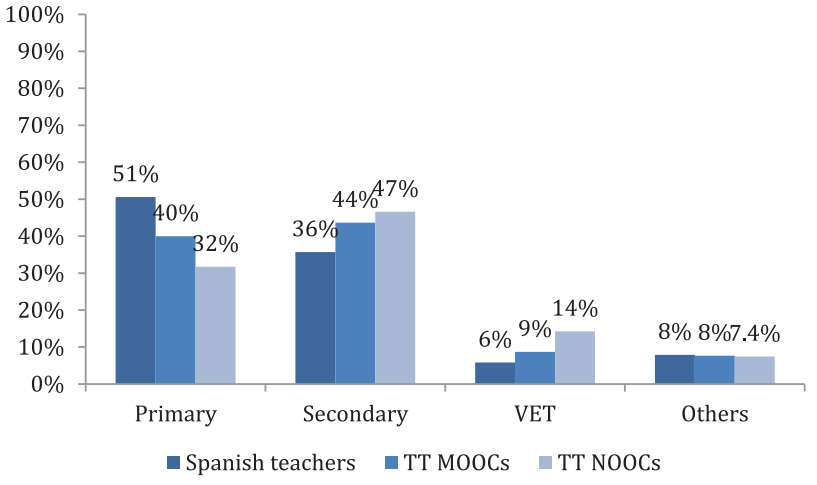

Figure 5. Teacher distribution by school level (excluding tertiary education).

6.4009, $p < .01$ for TTNOOCs. Furthermore, the percentage of Spanish primary teachers participating in TTMOOCs was higher than the percentage of Spanish teachers participating in TTNOOCs ($z = 2.81$, $p < .01$). See Figure 5.

Finally, the percentage of Spanish teachers working in public schools participating in INTEF's TTMOOCs (64%) was lower than expected, taking into consideration the percentage of Spanish teachers working in public schools (71%). This difference was significant: z = 6.233, $p < .01$ for TTMOOCs. However, no significant difference was found between TTNOOCs and the Spanish overall teacher population ($z = –0.9$, $p = .35$). The difference in the percentage of Spanish teachers working in public schools between TTMOOCs and TTNOOCs was also found to be significant ($z = –3.86$, $p < 0.01$), confirming that the percentage of public school teachers enrolled in NOOCs was higher than the percentage of public school teachers enrolled in MOOCs. See Figure 6.

Lifelong learning and previous MOOC experience

Needs for and barriers to TPD

In order to study how training needs for and barriers to TPD affected Spanish teachers' participation in MOOCs, we compared data from INTEF TTMOOCs with the data from the 2013 TALIS survey

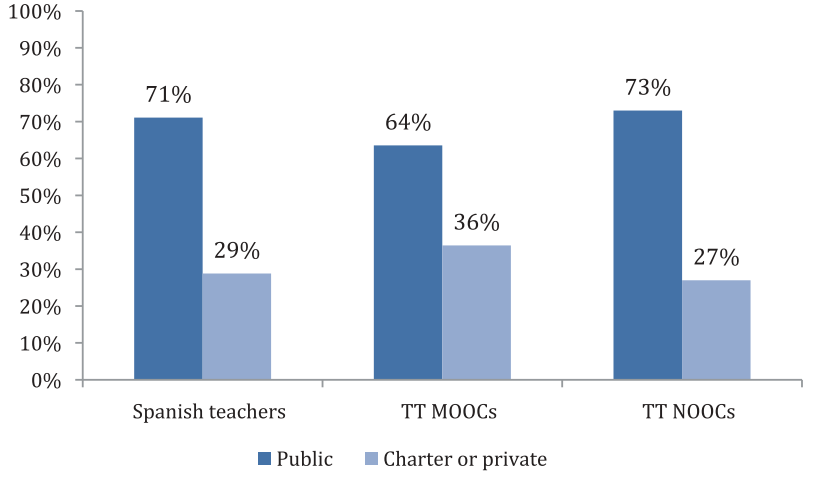

Figure 6. Type of school.

that is concerned with the overall population of Spanish teachers. From this comparison, we see that MOOCs were recognised as a way of overcoming some important barriers to TPD, including lack of availability and time flexibility. Spanish teachers in INTEF TTMOOCs considered the lack of professional development opportunities to a lesser extent (28%) as a barrier compared with the general population of Spanish teachers (61%). The difference in the percentage of people who considered the lack of professional development opportunities as a barrier to TPD between TTMOOCS and Spanish teachers participating in TALIS was significant: $z = 17.04$, $p < .01$. In addition, the rate of individuals who considered that TPD leads to conflicts with their work schedule was lower among participants in INTEF MOOCs (44%) than among the overall population of Spanish teachers (60%). The difference in the percentage of people who consider the conflict between professional development and work schedule as a barrier to TPD between TTMOOCS and Spanish teachers participating in TALIS was significant: $z = -8.61$, $p < .01$.

MOOCs were also seen as a good way to widen access to TPD for those teachers who had more difficulties in accessing traditional TPD. Indeed, INTEF TTMOOCs were taken by Spanish teachers who reported having more problems with the entrance pre-requisites than the Spanish teachers in the overall TALIS sample (21% vs 8%). The difference in the percentage of people who consider lack of entrance pre-requisites as a barrier to TPD between TTMOOCS and Spanish teachers participating in TALIS was significant: $z = 12.392$, $p < .01$. Similarly, Spanish teachers in INTEF TTMOOCs considered the lack of employer support as a barrier to a greater extent than Spanish teachers in the TALIS study (39% vs 30%). The difference in the percentage of people who considered the lack of employer support as a barrier to TPD between TTMOOCS and Spanish teachers participating in TALIS was significant: $z = 5.55$, $p < .01$. Finally, although it is also significant, the lack of incentives for participation in TPD was a less important barrier for Spanish teachers in INTEF MOOCs than for Spanish teachers in the overall population sampled in TALIS. The difference in the percentage of people who considered the lack of incentives as a barrier to TPD between TTMOOCS and Spanish teachers participating in TALIS was significant: $z = -14.77$, $p < .01$. See Figure 7.

In general, Spanish teachers in INTEF MOOCs showed a higher need for training than the overall population of Spanish teachers. However, when analysed by topic there was an important exception: INTEF TTMOOC Spanish teachers had a lower need for training in ICT skills for teaching than the overall Spanish teacher population had. The difference in the percentage of people who

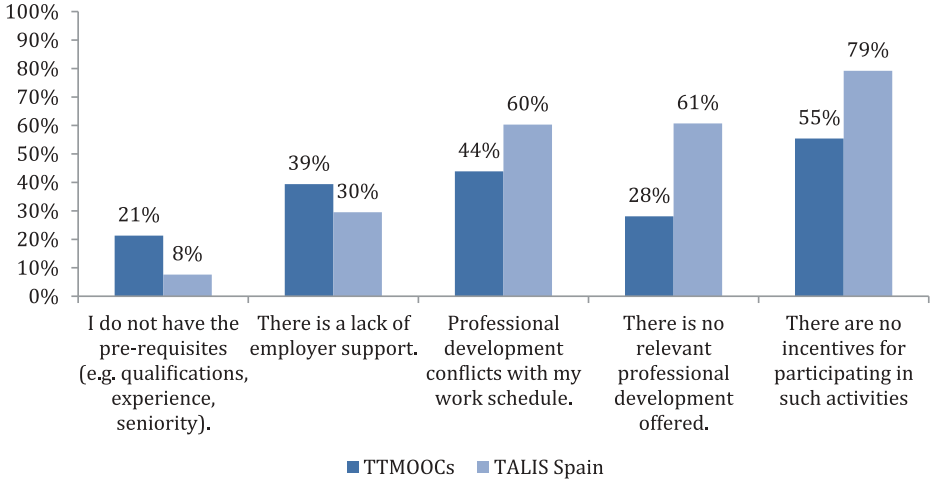

Figure 7. Barriers to TPD (excluding tertiary education).*

*Information available for only three TTMOOCs: Cooperative Learning, Open E-twinning (3rd edition) and Gamification.

declared ICT skills for teachers as a TPD need between TTMOOCS and Spanish teachers participating in TALIS was significant: $z = -6.73$, $p < .01$. Possibly, MOOCs aimed at providing skills for the use of ICT in education were taken by individuals who already had good ICT skills or, at least, fewer training needs in this area. See Figure 8.

Previous MOOC experience

When we focus only on the participants of MOOCs, more first-time participants enrolled in INTEF's TTMOOCs and TTNOOCs than in general MOOCs (46% in TTMOOCs and 23% in TTNOOCs vs 15% in general MOOCs). The differences in the percentage of individuals who were first-time participants between TTMOOCS/TTNOOCS and regular MOOCS were significant: $z = 15.82$, $p < .01$ for TTMOOCs and $z = 3.98$, $p < .01$ for TTNOOCs. In addition, when comparing TTMOOCs and TTNOOCs we found a higher percentage of first-time participants among TTMOOCs learners ($z = 9.75$, $p < .01$). See Figure 9.

Figure 10 shows the percentage of participants who had completed all the MOOCs they had enrolled in previously. Results revealed a higher completion rate for participants in INTEF's TTMOOCs and TTNOOCS than for those in general MOOCs. Differences in participation rates of individuals who had completed all the MOOCs between TTMOOCS/TTNOOCS and regular MOOCS were significant: $z = 6.994$, $p < .01$ for TTMOOCs and $z = 4.425$, $p < .01$ for TTNOOCs. Taking into account the fact that learners who respond to course surveys tend to be active learners (Evans et al., 2016), this indicates that active participants in TTMOOCs were more likely to complete the course than active participants in general MOOCs. See Figure 10.

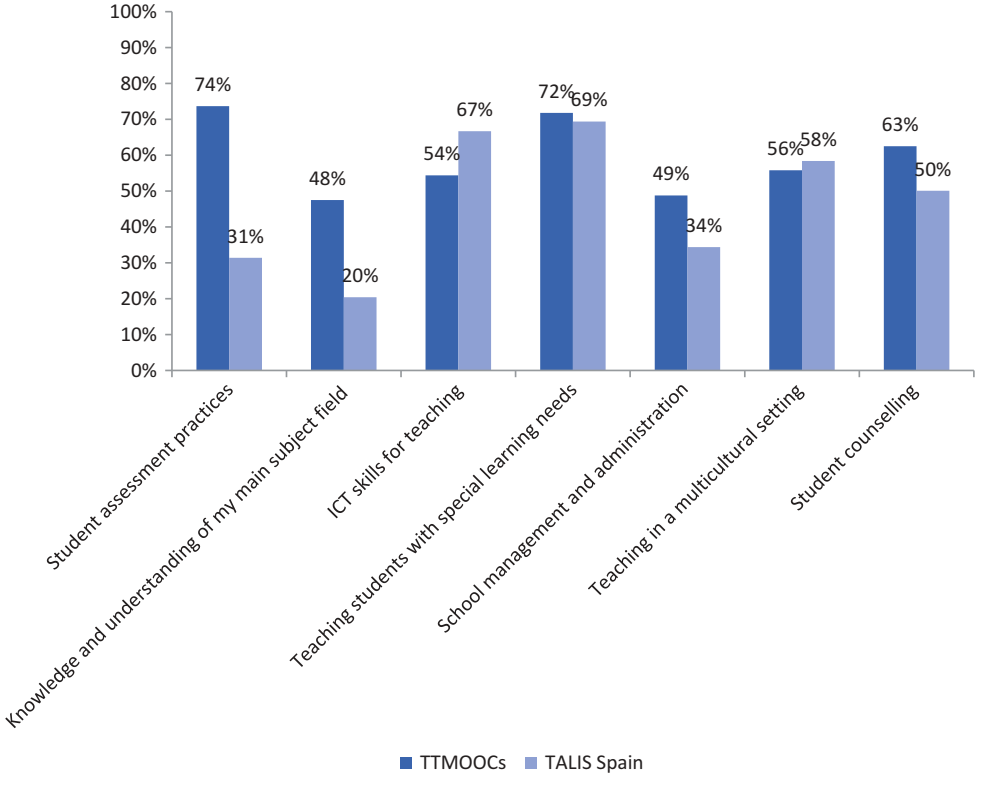

Figure 8. TPD needs (excluding tertiary education).*

*Information available for three TTMOOCs: Cooperative Learning, Open E-twinning (3rd edition) and Gamification.

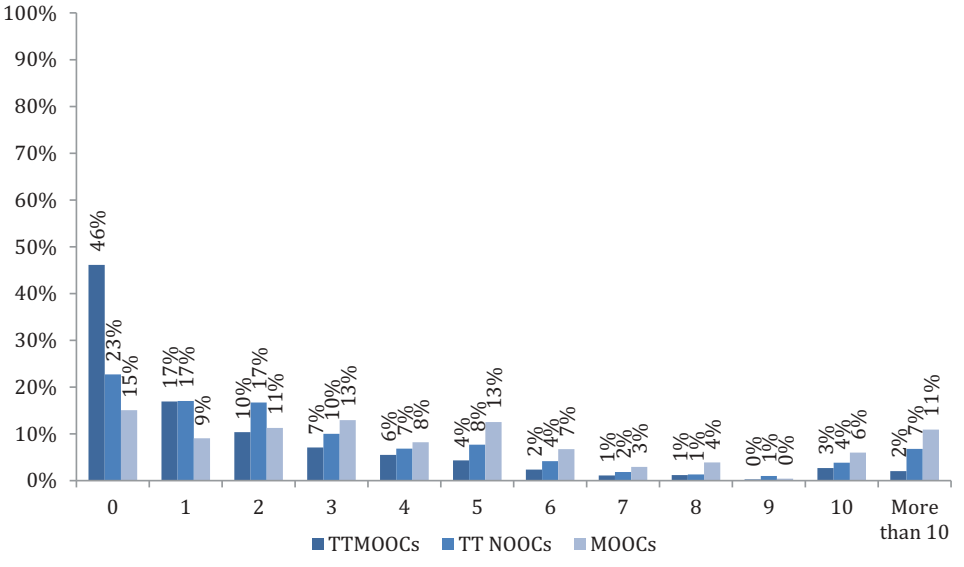

Figure 9. Number of MOOCs participants enrolled in previously.

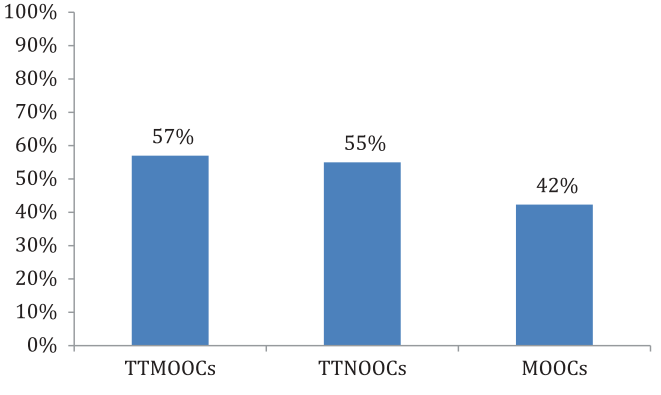

Figure 10. Percentage of completion of all (100%) previous MOOCS.

Regarding the sources Spanish participants in TTMOOCs used to find information on MOOCs, teachers turned mainly to the Internet and their personal networks and to a lesser extent to colleagues in their institutions. Differences between the percentage of teachers finding information on MOOCs through colleagues and the percentage of primary teachers finding information on MOOCs on the Web or via someone they know were all significant: $z = -6.37$, $p < .01$ for 'Web (by chance)'; $z = -3.50$, $p < .01$ for 'Web (intended)'; and $z = -7.32$, $p < .01$ for 'Someone I know'. This lack of information sharing may point to a need for more structured awareness raising on MOOCs as a format for professional development for them. See Figure 11.

MOOCs and job relevance

Compared with general MOOCs, fewer participants in INTEF MOOCs were unemployed (5.4% in TTMOOCs, 7.7% in TTNOOCs vs 26.5% in general MOOCs). Differences in participation rates of the

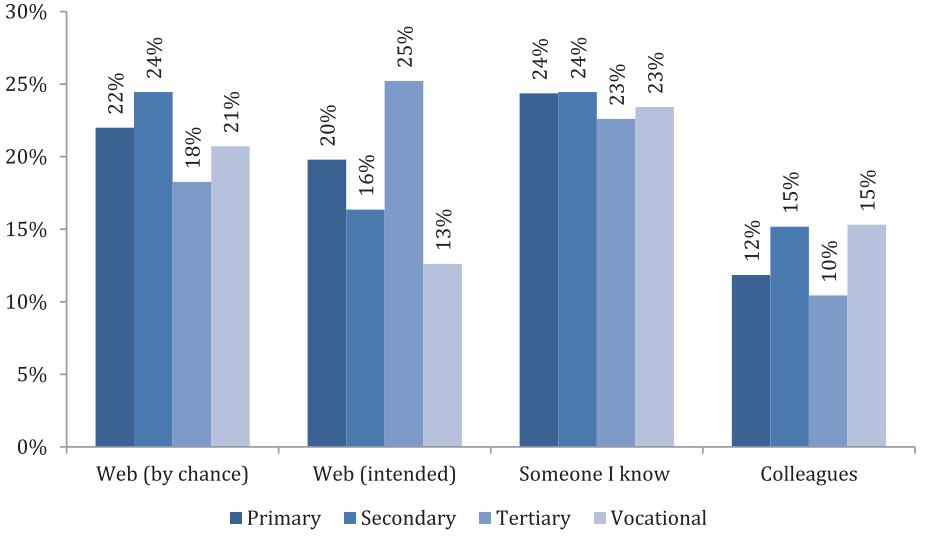

Figure 11. Teachers' information sources for MOOCs by school educational level.*

*NOOCs are not included. Multiple responses were possible.

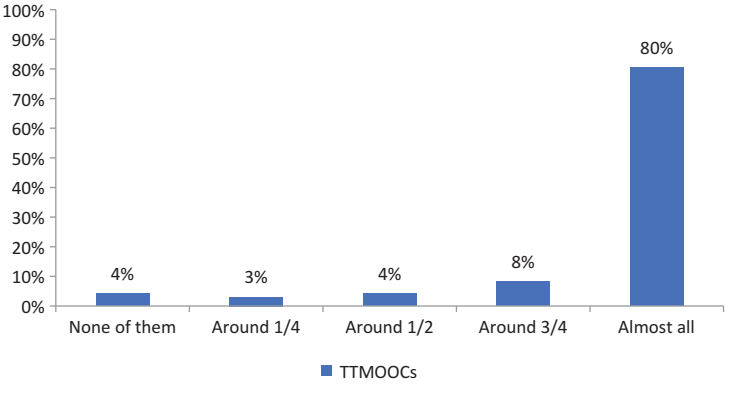

Figure 12. Proportion of previous MOOCs taken for professional development.*

*NOOCs are not included.

unemployed between TTMOOCS/TTNOOCS and general MOOCS were significant: $z = 15.757$, $p < .01$ for TTMOOCs and $z = 9.4$, $p < .01$ for TTNOOCs.

Teachers usually signed up for MOOCs for TPD. From the participants, 80% had previous experience with MOOCs, and this group of participants declared that almost all the MOOCs they took were related to their jobs. See Figure 12.

In general MOOCs, 71% of participants declared that their employers were unaware of their participation in professional development activities (and therefore in MOOCs). In INTEF's TTMOOCs, however, this share was only 48%.

Sixty-six per cent of Spanish teachers in TTMOOCs, and whose employers knew about their participation in professional development activities, felt they received support for their professional development activities from their school. This is a lower share when compared with participants in general MOOCs (76%). The difference in participation rates of individuals who felt they received

support for their professional development activities between TTMOOCS and regular MOOCS is significant at 0.1 level: $z = 1.87$, $p < 0.1$. See Figure 13.

The data indicated that Spanish teachers from higher education and vocational education felt they had more support than those in primary or secondary education. The difference was, however, not significant. See Figure 14.

Before starting the courses, Spanish participants in INTEF's TTMOOCs and TTNOOCs typically expected this training to primarily help them to stay up to date or to do new/other things in their work but few participants expected to improve their career chances. In contrast, the participants in general MOOCs tended to expect an improvement in their labour market chances. The differences in the mean scores associated with the belief that MOOCs will increase labour market chances

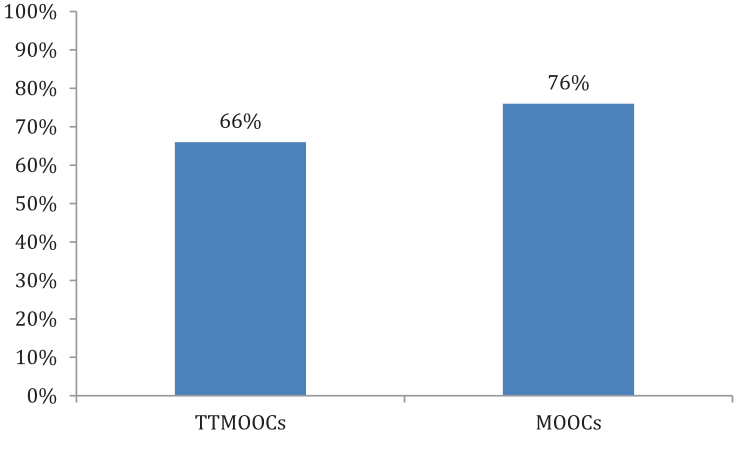

Figure 13. Employer support for professional development.*+

*NOOCs are not included.
+Information available for only four TTMOOCs: Sense of Initiative and Entrepreneurship in the Classroom, Open E-twinning (2nd edition), Educational Use of Digital Storytelling, and Teaching and Assessing Digital Competence.

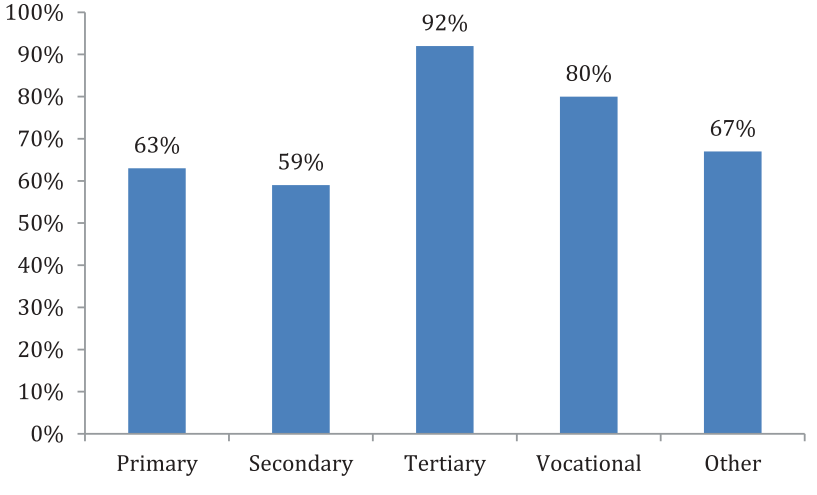

Figure 14. Employer support for professional development by school level.*+

*NOOCs are not included
+Information available for only four TTMOOCs: Sense of Initiative and Entrepreneurship in the Classroom, Open e-Twinning (2nd edition), Educational Use of Digital Storytelling, and Teaching and Assessing Digital Competence.

between participants in TTMOOCS and TTNOOCs and participants in regular MOOCS were significant: $t = 17.33$, $p < .01$ for TTMOOCs and $t = 16.27$, $p < .01$ for TTNOOCs. See Figure 15.

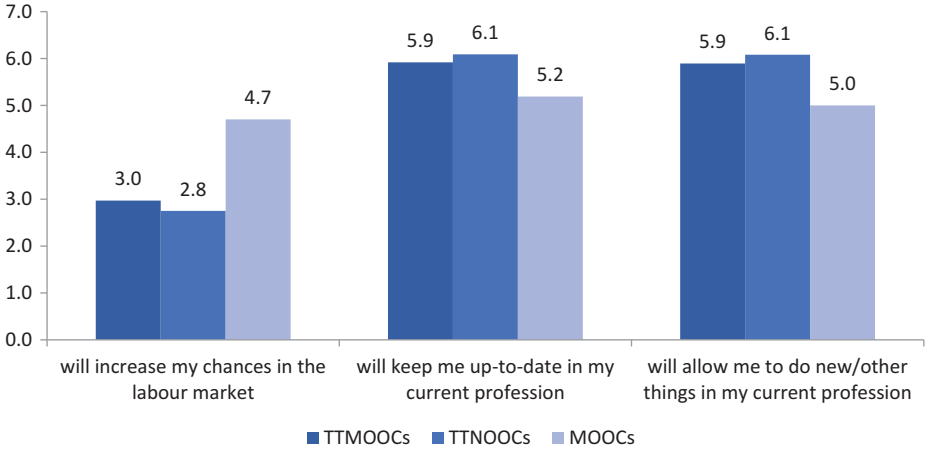

Figure 15. Expected professional benefits from MOOC participation.*
*Scale from 1 (*never*) to 7 (*always*).

Discussion

Spanish teachers report that they need training on the use of ICT for teaching and learning. The Spanish MOOC initiative by INTEF aims to meet this need. By analysing a unique dataset on this initiative and comparing the results with other available data, this article sheds light on the characteristics of participants in MOOCs for teachers' professional development in Spain, with special emphasis on ICT use in the classroom. All in all, the results presented in this article allow us to respond to our research questions.

First of all, the data show the characteristics of the Spanish participants in INTEF's TTMOOCS and TTNOOCs (RQ1). Secondly, we have detected how these characteristics differ from those of the overall population of Spanish teachers in at least three ways: age, gender and school level (RQ2). Considering that the INTEF's TTMOOCS and TTNOOCs analysed in this article were related to the use of ICT in education, the overrepresentation of learners aged between 40–49 years may be explained by, on the one hand, a greater need for upskilling or reskilling in this area than younger teachers and, on the other hand, younger teachers having more working years ahead in which to benefit from investment in new skills acquisition. Indeed, there is some evidence about how the demand for training in 'ICT skills for teaching' and 'new technologies in the workplace' increases with age (European Commission, 2015, figure 3.2.2).

The lower participation of women and primary school-level teachers is correlated. With the focus only on secondary schools, the percentage of women participating in MOOCs is similar to the percentage of women in the overall population of teachers. It may be explained by the existence of a gender gap related to technology usage but also by a lack of interest in (or need for) the integration of technology in primary schools. Further research is needed to shed light on the reasons. Nevertheless, this can be a barrier if the integration of technology in

educational practices and the improvement of teachers' digital competence are policy objectives for primary education.

Regarding the differences between the characteristics of the Spanish participants in INTEF's TTMOOCS (RQ3) and TTNOOCs and the characteristics of Spanish participants in general MOOCs (not aimed at teacher training), it is worth highlighting that Spanish teachers with TTMOOC experience seem to value this new channel for professional development and, when they started the activities, they were committed to completing these TPD MOOCs.

In addition, more Spanish participants in TTMOOCs and TTNOOCs were enrolled for the first time in a MOOC when compared with Spanish participants on general MOOCs. It may signal the success of the INTEF initiative when attracting teachers to this new TPD model.

When exploring the potential of MOOCs for taking away existing barriers to TPD in Spain (RQ4), our data from three INTEF TTMOOCs show that there is potential to widen access to TPD, especially for those teachers who have more difficulties in accessing traditional TPD. MOOCs seem to be a good option for those teachers with lack of entrance pre-requisites, lack of school support to follow other types of TPD or lack of time to follow less flexible training. In addition, participants in INTEF TTMOOCs considered the lack of professional development provision as a barrier to a lesser extent compared with Spanish data from TALIS. This can be explained because participants in INTEF TTMOOCs were able to participate in the MOOCs' ecosystem and, therefore, had a professional development opportunity within reach. Moreover, lack of incentives for participation in TPD is considered as a barrier by Spanish teachers in INTEF TTMOOCs to a lesser extent than by the TALIS sample of Spanish teachers. One possible explanation is that MOOC participants are intrinsically motivated to acquire new skills and therefore place less value on external incentives/recognition.

Finally, to answer our last research question (RQ5), it must be highlighted that TTMOOCs and TTNOOCs seem to attract slightly different profiles of participants. Spanish female primary teachers were more likely to participate in TTMOOCs. This was also true for Spanish teachers working in private or charter schools when compared with their counterparts in public ones.

Beyond these differences between the profiles of the learners, an important contrast between TTMOOCs and TTNOOCs is their completion rate (6% for TTMOOCs and 25% for TTNOOCs). This shows a clear impact of workload on completion of the courses and opens the door to innovative strategies for TPD design such as offering what is considered the most important content of traditional MOOCs in a short MOOC format, facilitating greater completion of the selected micro-learning activity. But it has to be noted that TTMOOCs usually have higher enrolments than TTNOOCs. It has been found that the percentage of first-time participants was higher among Spanish TTMOOCs participants than among Spanish TTNOOCs. This might be explained by the duration and structure of the courses. TTNOOCs are short, interrelated courses and therefore it is more plausible that learners participated in several of them. In order to study further the effect of the TPD MOOCs' length, future research on TPD should focus on comparing the different levels of engagement and completion of the same content and learning that TPD MOOCs presented in different lengths and formats may have.

Finally, our data also show an interesting trend of TTMOOCs regarding their completion rates: the percentage of participants who had completed all the MOOCs they had previously enrolled in is higher for participants in INTEF's TTMOOCs and TTNOOCS than for general MOOCs. However, taking into account the completion rates shown in Table 1, this does not necessarily mean higher completion rates. Indeed, the completion rate of the Spanish Miriadax platform MOOCs is on average around 18% (Oliver, Hernández-Leo, & Albó, 2015) and the median completion rate in different MOOC platforms around 6.5% (Jordan, 2014). The figures presented in Figure 10 combined with the figures about completion rates in Table 1 indicate that individuals enrolled in TTMOOCs started learning activities less often than individuals enrolled in general MOOCs, but also that they were more persistent learners when they did start.

Conclusions

Our study contributes to the body of knowledge on the use of Massive Open Online Courses for the professional development of teachers. While there is currently a scarcity of research on the participant profile, enrolment context and the need for TPD for teachers, our study contributes findings that help to further design and develop tailored provision for teachers. Although our research focuses on a single country, some practical implications for fostering the use of MOOCS for TPD can be derived from it which are also relevant for other countries or institutions aiming to promote initiatives using MOOCs for TPD. First, from the results of our study we can conclude that MOOCs have become an alternative channel for professional development of teachers. In addition, they show potential to scale up TPD and remove participation barriers, although in Spain ministries of education tend to not officially recognise this format for professional development (Spanish Government, 2011). An addition of formal recognition of MOOC-based TPD via reliable, alternative methods of assessment and learner identification, together with changes to regulation to include MOOCs among recognised forms of professional development, could make MOOCs more widely accepted for professional development.

Second, we have seen that MOOCs for TPD are still in their infancy and their use is not widespread. If participation of teachers in MOOCs on ICT and education is an objective, awareness needs to be raised on its usefulness, and according to our data primarily among female primary school teachers. Teachers generally found information on MOOCs when using the Internet for their own purposes, or from their personal contexts. There seems to be a lack of information and knowledge exchange among colleagues at the school level and only a small percentage find information about MOOCs in their professional context. A more structured flow of information via, e.g., schools, school heads or teacher organisations like unions, could improve awareness and participation and make MOOCs a real complementary element to the traditional teacher training provision.

The current study has several limitations. First of all, the sample of the study was limited to Spanish participants of MOOCs on ICT and education. While we have compared this population with a general MOOC population and also the general teacher population in Spain, the representativeness of the findings could be limited owing to the sampling approach. In addition, a general problem in MOOCs is that response to online questionnaires often leads to overrepresentation of active and motivated participants, which could be another source of bias.

Subsequent research must aim to further increase knowledge about MOOCs by comparing the findings of this study with findings from other countries. In addition, in order to go beyond the descriptive analysis and measure the real impact on teaching practices and efficacy of the educational systems, the impact of MOOC participation on teacher practices should be analysed in follow-up surveys of the teacher population.

Note

The views expressed in this article are purely those of the authors and should not be regarded as the official position of the European Commission.

Acknowledgements

The authors would like to thank INTEF for the collaboration with the MOOCKnowledge project, especially Miguel A. Hernáiz Lasanta and María Jesús García San Martín, who facilitated the data collection.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work has been partially funded by a tender [JRC/SVQ/2013/J.3/0035/NC] of the European Commission's Joint Research Centre.

Notes on contributors

Jonatan Castaño-Muñoz is a researcher working at the European Commission Joint Research Centre. He is part of the Human Capital and Employment Unit and his research is focused on higher education and the implications of the use of e-learning for education and labour markets systems.

Marco Kalz is Full Professor of Technology-Enhanced Learning at the Heidelberg University of Education. He is also affiliated to the UNESCO Chair of Open Education at the Faculty of Management, Science and Technology of the Open University of the Netherlands. In his research he is focusing on dismantling barriers for participation in lifelong learning via digital technologies. His research focus lies on open education, mobile learning and technology-enhanced assessment.

Karel Kreijns is an associate professor at the Welten Institute of the Open University of the Netherlands. His primary research interests are computer-supported collaborative learning, the application of self-determination theory, the I-Change model and the reasoned action approach on teachers' use of technology/open educational resources, enrolling in MOOCs, and teachers' professional development activities (e.g. innovative behaviour, action research, twenty-first-century skills).

Yves Punie is Senior Scientist at the European Commission Joint Research Centre in Seville, Unit Human Capital and Employment. He is leading its research and policy activities on 'ICT for Learning and Skills'. The research area started in 2005 with the aim to provide evidence-based policy support to the European Commission on harnessing the potential of digital technologies to innovate education and training practices, improve access to lifelong learning and deal with the rise of new (digital) skills and competences needed for employment, personal development and social inclusion.

ORCID

Jonatan Castaño-Muñoz http://orcid.org/0000-0002-6112-2728
Marco Kalz http://orcid.org/0000-0003-1471-5827
Karel Kreijns http://orcid.org/0000-0002-8714-4415

References

Bauer, J., & Prenzel, M. (2012). European teacher training reforms. *Science*, *336*(6089), 1642–1643.

Beaudry, O., Green, D.A., & Sand, B. M. (2016). The great reversal in the demand for skill and cognitive tasks. *Journal of Labor Economics*, *34*(S1), 199–247.

Bond, T., & Fox, C. M. (2015). *Applying the Rasch model: Fundamental measurement in the human sciences* (3rd ed.). New York, NY: Routledge.

Castaño-Muñoz, J., Kreijns, K., Kalz, M., & Punie, Y. (2016). Does digital competence and occupational setting influence MOOC participation? Evidence from a cross-course survey. *Journal of Computing in Higher Education*. Retrieved from http://rd.springer.com/article/10.1007/s12528-016-9123-z

Castaño-Muñoz, J., Punie, Y., & Inamorato dos Santos, A. (2016). *MOOCs in Europe: Evidence from pilot surveys with universities and MOOC learners*. Retrieved from https://ec.europa.eu/jrc/sites/jrcsh/files/JRC%20brief%20MOOCs_JRC101956.pdf

Deci, E. L., & Ryan, R. M. (2000). The 'what' and 'why' of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 319–338.

European Commission. (2015). *Education and training monitor 2015*. Retrieved from http://ec.europa.eu/dgs/education_culture/repository/education/library/publications/monitor15_en.pdf

Evans, J. B., Baker, R. B., & Dee, T. (2016). Persistence patterns in Massive Open Online Courses (MOOCs). *The Journal of Higher Education*, *87*, 206–242. doi: 10.1080/00221546.2016.11777400

Evers, A., Van der Heijden, B. I. J. M., Kreijns, K., & Vermeulen, M. (2016). Job demands, job resources and flexible competence: The mediating role of teachers' professional development at work. *Journal of Career Development*, *43*, 227–243.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behaviour: The reasoned action approach*. New York, NY: Psychology Press.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. New York, NY: Taylor & Francis.
Hattie, J. (2015). The applicability of visible learning to higher education. *Scholarship of Teaching and Learning*, *1*, 79–91.
Ho, A. D., Reich, J., Nesterko, S. O., Seaton, D. T., Mullaney, T., Waldo, J., et al. (2014). *HarvardX and MITx: The first year of open online courses, Fall 2012–Summer 2013*. HarvardX and MITx Working Paper No. 1. doi:10.2139/ssrn.2586847
Jobe, W., Östlund, C., & Svensson, L. (2014, March 17). MOOCs for professional teacher development. In M. Searson & M. Ochoa (Eds.), *Proceedings of Society for information Technology & Teacher Education international conference 2014* (pp. 1580–1586). Chesapeake, VA: AACE.
Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *The International Review of Research in Open and Distributed Learning*, *15*(1), 133–160. doi:10.19173/irrodl.v15i1.1651
Kalz, M., Kreijns, K., Walhout, J., Castaño-Munoz, J., Espasa, A., & Tovar, E. (2015). Setting-up a European cross-provider data collection on open online courses. *The International Review of Research in Open and Distributed Learning*, *16*(6), 62–77. doi:10.19173/irrodl.v16i6.2150
Kasch, J., Van Rosmalen, P, & Kalz, M. (2017). A framework towards educational scalability of open online courses. *Journal of Universal Computer Science*, 23, 845–867.
Kleiman, G., Wolf, M. A., & Frye, D. (2013). *The digital learning transition MOOC for educators: Exploring a scalable approach to professional development*. White Paper. Retrieved from http://all4ed.org/wp-content/uploads/2013/09/MOOC-Ed.pdf
Laurillard, D. (2014). *Anatomy of a MOOC for teacher CPD*. Technical report. UCL Institute of Education.
Laurillard, D. (2016). The educational problem that MOOCs could solve: Professional development for teachers of disadvantaged students. *Research in Learning Technology*, *24*, 29369.
Longworth, N. (2003). *Lifelong learning in action: Transforming education in the 21st century*. London: Kogan Page.
Oliver, M., Hernández Leo, D., & Albó, L. (2015). *MOOCs en España. Análisis de la demanda* [MOOCS in Spain. Analysis of demand]. Cuaderno Red de Cátedras Telefónica. Retrieved from fhttp://repositori.upf.edu/bitstream/handle/10230/25400/MOOCs_2015_Analisidemanda.pdf?sequence=1
Organisation for Economic Cooperation and Development (OECD). (2014). *TALIS 2013 results: An international perspective on teaching and learning*. Paris: OECD.
Organisation for Economic Cooperation and Development (OECD). (2017). *Pedagogical knowledge and the changing nature of the teaching profession*. Paris: OECD.
Pynoo, B., Kerckaert, S., Goeman, K., Elen, J., & van Braak, J. (2013). *MICTIVO2012. Monitor voor ICT-integratie in het Vlaamse onderwijs. Beleidssamenvatting van OBPWO-project 11.02* [MICTIVO2012. Assessment of the ICT integration in de educational system of Vlaanderen. Policy summary of the OPBW project]. Universiteit Gent/KU Leuven/Hogeschool Universiteit Brussel.
Seaton, D. T., Coleman, C. A., Daries, J. P., & Chuang, I. (2014, October 29). Teacher enrollment in MITx MOOCs: Are we educating educators? *EDUCAUSEreview*. Retrieved from SSRN: https://ssrn.com/abstract=2515385 or doi:http://dx.doi.org/10.2139/ssrn.2515385
Spanish Government. (2011). *Orden EDU/2886/2011, de 20 de octubre, por la que se regula la convocatoria, reconocimiento, certificación y registro de las actividades de formación permanente del profesorado* [Order EDU/2886/2011 on 20th of October, regulating the recognition and registration of teachers' professional development activities]. *Boletín Oficial del Estado*. Retrieved from https://www.boe.es/boe/dias/2011/10/28/pdfs/BOE-A-2011-16923.pdf
Spanish Ministry of Education. (2016). *Datos y cifras. Curso escolar 2015/2016* [Facts and figures. School year 2015/2016]. Ministerio de Educación, Cultura y Deporte. Retrieved from https://sede.educacion.gob.es/publiventa/detalle.action?cod=20460
UNESCO. (2009). *Belém framework for action: Harnessing the power and potential of adult learning and education for a viable future*. (UNESCO: CONFINTEA VI: December, 2009). Retrieved from http://www.unesco.org/en/confinteavi
Vivian, R., Falkner, K., & Falkner, N. (2014). Addressing the challenges of a new digital technologies curriculum: MOOCs as a scalable solution for teacher professional development. *Research in Learning Technology*, *22*(0). doi:10.3402/rlt.v22.24691
Voogt, J., van Braak, J., Heitink, M., Verplanken, L., Fisser, P., & Walraven, A. (2014). *Didactische ICT-bekwaamheid van docenten* [Didactical ICT-competences of teachers]. Enschede: Universiteit Twente. Retrieved from http://www.kennisnet.nl/uploads/tx_kncontentelements/Kennisnet_verslag_definitief_11022014_didactische_ict_bekwaamheid.pdf
Vuorikari, R., Punie, Y., Carretero, S., & van den Brande, G. (2016). *Digcomp 2.0: The digital competence framework for citizens. Update phase 1: The conceptual reference model*. Luxembourg: Publications Office of the European Union.