Assessment in Massive Open Online Courses

Wilfried Admiraal[1], Bart Huisman[1] and Olga Pilli[1,2]
[1]Leiden University Graduate School of Teaching, Leiden, The Netherlands
[2]Faculty of Education, Girne American University, Girne, North-Cyprus
w.f.admiraal@iclon.leidenuniv.nl
b.a.huisman@iclon.leidenuniv.nl
o.pilli@iclon.leidenuniv.nl

Abstract: Open online distance learning in higher education has quickly gained popularity, expanded, and evolved, with Massive Open Online Courses (MOOCs) as the most recent development. New web technologies allow for scalable ways to deliver video lecture content, implement social forums and track student progress in MOOCs. However, we remain limited in our ability to assess complex and open-ended student assignments. In this paper, we present a study on various forms of assessment and their relationship with the final exam score. In general, the reliability of both the self-assessments and the peer assessments was high. Based on low correlations with final exam grades as well as with other assessment forms, we conclude that self-assessments might not be a valid way to assess students' performance in MOOCs. Yet the weekly quizzes and peer assessment significantly explained differences in students' final exam scores, with one of the weekly quizzes as the strongest explanatory variable. We suggest that both self-assessment and peer assessment would better be used as assessment *for* learning instead of assessment *of* learning. Future research on MOOCs implies a reconceptualization of education variables, including the role of assessment of students' achievements.

Keywords: MOOC; Open Online Learning; Higher education; Assessment; Peer assessment; Self-assessment; Quiz

1. Introduction

In recent years, free access has been provided to content which previously had a price: searches, software, music and references, to name but a few. Access to the Internet and broadband has increased rapidly and huge growth in mobile connectivity has brought online content and interaction to a global audience. At the same time, open online distance learning in higher education has quickly gained popularity, expanded, and evolved. Recently, Massive Open Online Courses (MOOCs) appear to be a significant force within higher education. However, while new web technologies allow for scalable ways to deliver video lecture content, implement social forums and track student progress, we remain limited in our ability to evaluate and give feedback for complex and often open-ended student assignments. Self- and peer assessment might offer promising solutions that can scale the grading of complex assignments in courses with thousands of students. Moreover, intermediate assessments might engage more students with participating in a course. In this study, we provide insights into various forms of assessment that are applied in three Leiden University MOOCs in the Coursera platform.

2. Massive Open Online Courses (MOOCs)

A typical MOOC of 2014 might take place over 4 to 10 weeks. Students, on average, dedicate two to six hours a week to the course. Materials are consumed in diminishing volumes throughout the MOOC as many learners' commitment wanes. Course applicants can be numbered in the tens of thousands, while those who complete and obtain certificates are usually numbered in the hundreds. As in regular higher education, the value of a MOOC for student learning highly depends on how learning processes are facilitated, stimulated and assessed.

The most influential categorization of MOOC pedagogy relates to the notion that there are two main kinds of MOOCs, each of which determines a particular pedagogical approach: the connectivist or cMOOC, driven by pedagogical principles of social learning, and the institutionally-focused xMOOC, reliant on video-lecture content and automated assessment. Table 1 indicates the basic differences between cMOOCs and xMOOCs.

Reference this paper as Admiraal W, Huisman B and Pilli O "Assessment in Massive Open Online Courses" *The Electronic Journal of e-Learning Volume 13 Issue 4 2015*, (pp207-216) available online at www.ejel.org

2.1 cMOOC

Connectivist MOOCs (cMOOCs) are directed by explicit principles of connectivism: autonomy, diversity, openness and interactivity (Bell 2010), and it is expected to be hosted by using free social network sites, wikis, and blogs (Rodriguez 2013). Four significant design principles of cMOOCs are generally acknowledged (Bates, 2014; Kop, 2011):

- Autonomy of the learner: Learners choose what content or skills they wish to learn, which makes learning personal without a formal curriculum
- Diversity: Learners use various tools and content and they differ in knowledge levels
- Interactivity: Learners collaborate, co-operate and communicate, resulting in emergent knowledge
- Openness: Learners have free access to content, activities and assessment

PLENK2010 (Personal Learning Environments, Networks, and Knowledge), CCK 08, 09, 11 (Connectivism and Connective Knowledge), MobiMOOC 2010 (Mobile Learning) and EduMOOC (ONLINE Learning today and tomorrow courses) are the main examples of cMOOCs (Ebben and Murphy 2014; Kop 2011; Rodriguez 2012).

2.2 xMOOC

XMOOCs are characterised by the step by step learning, breaking down the content into small steps, limited feedback and interaction, pre-determined office-hours for students questions, and criterion-referenced based assessment approaches (Ebben and Murphy 2014). The xMOOCs follow the similar course design model of many of the on-campus higher education courses. The design of the courses unlike the cMOOCs is based on linear, content-based and objective-oriented learning paths. xMOOCs present the content of the course with a list of topics, readings, and small lecture videos. Students are assessed through a combination of quizzes, assignments and final exams and the format of the exam is mostly short-answer or multiple-choice questions. The most popular way of presenting course material is by pre-recorded video lectures which are typically between 3 to 15 minutes long (Bulfin, Pangrazio and Selwyn 2014; Hew and Cheung 2014). Udacity's CS101 and Coursera's Artificial Intelligence are well-known xMOOCs, which deliver online content from the instructors of top-ranked universities.

Table 1. xMOOCs vs. cMOOCs

Basic Features	xMOOCs	cMOOCs
Learning theories	Cognitive-behaviorist	Networking-connectivist
Teaching approach	Objective-oriented	Constructiion-oriented
Learning approach	Transfer of information	Sharing of knowledge between participants
Interaction	Limited interaction	Student-student, student-content, and student- instructor
Student role	Receivers, follow the instructions in video-based format, complete the assignments, quizzes and exams	Creators, contributors through blog posts, tweets, or discussion forms
Teacher role	The authority who is responsible to create the content, assignments, quizzes and exams deliver the lesson	Co-learner, create content and shape goals by working collaboratively with other learners
Content	Subject-compelled	Participant-compelled
Assessment	Multiple-choice tests, quizzes, computer-marked assignments, peer-review with the help of rubrics	No formal assessment , informal feedback from knowledgeable participants
Teaching materials	Lecture videos, text-based readings, slides, practice exercises, audio files, urls to other resources, and online articles	Social media; wikis, blogs, social networking sites(Facebook, Twitter, Google +),learning management systems (Moodle), Student-created videos and exercises

2.3 Other typologies of MOOCs

However, there is a move away from the cMOOC/xMOOC dichotomy towards recognition of the multiplicity of MOOC designs, purposes, topics and teaching styles, sometimes using alternative terms such as Distributed Open Collaborative Course (DOCC; Jaschik 2013), Participatory Open Online Course (POOC; Daniels 2013), Small Private Online Course (SPOC; Hashmi 2013) or Big Open Online Course (BOOC; Tattersall 2013). Another useful typology of MOOC has been proposed by Clark (2013) who has distinguished eight types of MOOCs based on their functionalities:

1) transferMOOCs that take existing courses and put them onto a MOOC platform with the pedagogic assumption of transfer from teacher and course content to learner similar to traditional academic courses with lectures, short quizzes, set texts and assessments.
2) madeMOOCs in which peer work and peer-assessment is used to cope with the high teacher-student ratios and which tend to be more vocational in nature, VOOCs (Vocational Open ONine Courses), where the aim is to acquire skills.
3) synchMOOCs which have a fixed start date, tend to have fixed deadlines for assignments and assessments and a clear end date.
4) asynchMOOCs which have no or frequent start dates, tend to have no or looser deadlines for assignments and assessments and no final end date. They can be taken anytime and anywhere.
5) adaptiveMOOCs use adaptive algorithms to present personalised learning experiences, based on dynamic assessment and data gathering on the courses. They take learners on different, personalised paths through the content.
6) groupMOOCs start with small, collaborative groups of students with the aim to increase student retention. They have mentors and rate each other's commitment and progress. Groups are also dissolved and reformed during the course.
7) connectivistMOOCs rely on the connections across a network rather than pre-defined content. These courses tend to create their own trajectory, rather than follow a linear path.
8) miniMOOCs are more suitable for precise domains and tasks with clear learning objectives and offer more intense experiences that last for hours and days, not weeks.

These different categorizations of MOOCs are based on varieties in pedagogies and assessment and their underlying ideas about effective learning.

3. Assessment in MOOCs

In a review of the literature and debate, Bayne and Ross (2013) extracted three emerging issues for MOOC pedagogy: 1) the role of the teacher, 2) learner participation and 3) assessment. Firstly, the role of the teacher in the MOOC has been under-examined as most research has investigated the learner perspective (Liyanagunawardena, Adams and Williams 2013). Two main teacher roles appear from the literature, which are connected to the way the MOOC is designed: the academic celebrity teacher in xMOOCs and the facilitator in cMOOCs. The academic celebrity teacher is the role of a respected authority based in an elite institution. These lecturers are not available to MOOC participants in any interpersonal way, but primarily through the recordings of their lectures. The recordings are supplemented with automatically marked quizzes, discussion posts and pass/fail tasks. In cMOOCs, the teachers' role focusses on facilitating self-directed learning. A more sophisticated distinction between teacher roles in MOOCs is necessary in order to get a better understanding of effective pedagogies. Literature on moderator roles in computer conferencing from the 90s (e.g., Admiraal, Lockhorst, Wubbels, Korthagen and Veen 1998; Paulsen 1995) might be helpful in this.

Secondly, learner participation is one the most examined aspects in literature and debates about MOOCs. The key dilemmas in MOOCs centre on what participation actually means, how it should be measured, and what metrics of success and quality are appropriate (DeBoer, Ho, Stump and Breslow 2014). Milligan, Littlejohn and Margaryan (2013) describe a continuum of active, lurking and passive participation and Hill (2013) distinguishes five archetypes of no-shows, observers, drop-ins, passive participants and active participants. The notion that people might sign up for a course not intending to complete the assessments is common in free courses where the barrier to entry is usually as low as clicking a registration button and entering an email address. This means that new measures of success and quality are required, because participant behaviours and intentions are so diverse.

Assessment is the third emerging issue in literature on MOOCs leading to questions like "What sorts of learning can be assessed at scale?", "How should individuals be authenticated so that the correct person's work is being assessed?", "How can cheating be prevented?", and "Who should decide how much university credit a MOOC is worth?", to name a view (cf. Bayne and Ross 2013). It becomes clear that "openness" of a MOOC has a very different future in a system of accreditation than that it does in informal learning settings. In general, the quality of assessment in MOOCs has been criticized by some authors (Admiraal, Huisman and Van de Ven 2014; Clarà and Barberà 2014). Reilly, Stafford, Williams and Corliss (2014) examined the effectiveness of automated essay scoring (AES) to assess writing assignments in two MOOCs. Three groups of assessments were compared: the AES-holistic grades, the AES-rubric grades and the instructor grades. AES-holistic grades and AES-rubric grades highly correlated, but both AES systems tended to give lower scores than the instructor, with the largest differences between instructor and AES-holistic grades. The authors concluded the AES tools gave less accurate assessments of the writing assignments presented in two MOOCs when compared to instructor assessment.

Self- and peer assessment - which has been historically used for logistical, pedagogical, metacognitive, and affective benefits - might offer promising solutions that can scale the grading of complex assignments in courses with thousands of students. How to design assessments is a challenge in itself as MOOCs have massive, diverse student enrolment. In the current study, we have examined various assessment forms in three MOOCs (quizzes, self-assessment and peer assessment of an essay, and final exam). More specific, we formulated the following research question:

1) What is the relationship between self- and peer assessment and quizzes?
2) To what extent do quizzes and self- and peer assessment explain differences in students' final exams scores?

4. Methods

4.1 Context of the study

In two MOOCs organized at Leiden University in the Netherlands, intermediate quizzes, self-assessments and peer assessments were used in addition to final exams. The first MOOC, *The Law of the European Union: An Introduction*, was a 5-8 weeks MOOC, run in June 2013. This course included small video clips, discussion fora, quizzes, a case study and a voluntary exam. The second MOOC, *Terrorism and Counterterrorism: Comparing Theory and Practice*, was a 5-weeks MOOC in Fall 2013 with weekly videos, quizzes and peer assignments as well as a voluntary final exam. This MOOC was rerun February 2014. All three courses required 5 to 8 hrs. student work per week.

4.2 Assessments

In each of the three MOOCs, four types of assessments were implemented: weekly quizzes, self-assessment, peer assessment and final exam.

4.2.1 Weekly quiz and final exam

The weekly quizzes and final exam were automatically marked multiple-choice quizzes, testing declarative knowledge of the course content. In MOOC 3 (Terrorism 2014), it was possible to follow a certification track, which means that students who completed all quizzes, self- and peer assessments and the final exam could receive a certificate. Of the total of 18,622 registrants, 410 students signed up for the certification track.

4.2.2 Self- and peer assessment

In each of the three MOOCs, students could complete an essay on a topic that was relevant for the particular MOOC. In the first MOOC, this topic was provided; in the other two MOOCs students could choose from four topics. The essay assignment started with a case description in which an authentic context was pictured, followed by some prompts. Students were encouraged to prepare this assignment with the use of information which was available in the course environment (video, syllabus, background materials). Then the procedures of how to complete the assignment were introduced along with a rubric of how to assess it. Students had to

assess their own essay and then the essay of at least two (in MOOC 1) or four (in MOOC 2 and 3) of their peers. The nature of the rubrics differed slightly between MOOC 1, on the one hand, and MOOC 2 and 3, on the other hand. The rubric of MOOC 1 had a pre-structured format with four items with several sub-items on the accuracy of the content of the essay and one item with four sub-items on the structure and the presentation of the essay. Each possible score on each sub-item was clearly described. The rubrics of MOOC 2 and 3 were less structured with four (assignment 1) or five (assignment 2) items. The first three items referred to the accuracy and adequacy of the content of the essay; the last item assessed the structure of the essay. Students were instructed about the deadlines and they were reminded that they agreed with the Coursera Honor Code about plagiarism. Students were instructed to assign a score of 0 to plagiarized work.

4.3 Data

Thousands of participants were registered in each of the three MOOCs, although substantial less data was collected on quizzes, self-assessments, peer-assessment assignments and final exam. From Table 1 it is clear that in all three MOOCs the number of participants who completed the quizzes decreased over time. The number of participants who completed self-assessments and peer assessments was a small portion of the total student enrolment. Participants who completed the voluntary final exam formed about 10% of the total student enrolment (from 6% in MOOC 1 to 12% in MOOC 3).

4.4 Analyses

In addition to descriptive statistics, reliability indices and correlations between all assessments, regression analyses were used to explain differences between students in their final exam scores.

5. Results

5.1 Four types of assessments

In Table 2, we present descriptive indices of each assessment (mean scores, standard deviations in scores, range of scores and number of valid assessments, respectively). The reliability of the self-assessments (based on 4 or 5 items) ranged from Cronbach's α= .59 in MOOC 2 to α= .83 in MOOC 1. This means that the pre-structured format of self-assessment in MOOC 1 showed the highest reliability. We observed a similar result in the reliability of the peer assessment with the highest reliabilities in MOOC 1 (three peer assessments α= .87, .89 and .90) and somewhat lower reliabilities in MOOC 2 (between α= .72 and .80) and MOOC 3 (between α= .59 and .79). In both types of assessment, the item that refers to the presentation (structure, layout, and language use) of the completed assignment showed the lowest item-rest correlations (between r= .55 and r= .64). The other items referred to an assessment of the content quality of the completed assignments. Given the small number of items, we can concluded that both self-assessment and peer assessment showed high internal homogeneity. The correlations between peer assessments of the same assignments were generally moderate (MOOC 2 mostly between r= .30 and .40) to strong (MOOC 1 between r= .42 and .57 and MOOC 3 mostly between r= .50 and .60). So, in general the reliability of both self-assessment and peer assessment was satisfactory.

5.2 Relationship between different assessment forms

The scores on the quizzes of the three MOOCs were generally highly correlated (between r=.50 and .77), but showed low to moderate positive correlations with self-assessment and peer assessment. Correlations between the MOOCs' quizzes and self-assessment were between r= .10 and .29, with most correlations around .15; Correlations between the quizzes and peer assessment were a somewhat higher, between r=.12 and .37 with most correlations .30 or higher. Finally the correlations between self-assessment and peer assessment scores of the same assignment were generally higher (mostly around r= .38) compared to the correlation between self-assessment and peer assessment scores of different assignments (mostly around r= .18). However, for both self-assessment and peer assessment the correlations between the scores on the two assignments in MOOC 2 and 3 were higher (r= .42 and .55 for self-assessment, and r= .43 and .47 for peer assessment) compared to the scores of the different assessment forms for the same assignment. In other

words, the relationship between the same assessment forms is stronger than between the assessments of the same assignment.

Table 2. Descriptive indices of assessment types (N=number of registrants; Mean=mean score; SD= standard deviation in scores; Min/Max=range of scores; n=number of valid assessments)

	MOOC 1 N= 52559				MOOC 2 N= 26890				MOOC 3 N= 18622			
	Mean (SD)	Min	Max	n	Mean (SD)	Min	Max	n	Mean (SD)	Min	Max	n
Quizzes												
1	3.75 (1.41)	0	5	7472	8.83 (1.48)	0	10	5399	8.83 (1.69)	0	10	4459
2	3.42 (1.38)	0	5	4322	9.03 (1.37)	0	10	4077	9.01 (1.47)	0	10	3288
3	4.21 (1.18)	0	5	3349	12.07 (2.22)	0	14	3593	8.59 (1.82)	0	10	2810
4	3.80 (1.32)	0	5	3050	13.34 (2.18)	0	15	3230	8.83 (1.72)	0	10	2466
5	--	--	--	--	9.02 (1.56)	0	10	3014	8.98 (1.62)	0	10	2296
Self-assessment												
1	17.94 (4.34)	4	25	397	28.30 (2.99)	10	30	706	18.58 (2.85)	0	20	572
2	--	--	--	--	37.95 (3.71)	5	40	561	37.37 (5.24)	5	40	475
Peer assessment												
1	15.29 (5.42)	0	25	688	25.23 (5.20)	10	30	824	16.38 (4.45)	0	20	635
2	--	--	--	--	32.86 (7.52)	5	40	579	33.71 (6.70)	5	40	491
Final exam												
	11.44 (5.48)	0	20	3168	17.26 (5.58)	0	25	2988	17.44 (5.81)	0	25	2274

5.3 Relationship between different assessment forms and the final exam

In Table 3, the results of the stepwise regression analyses for each MOOC are summarized. Both self-assessments did not significantly explain differences between students in their final exam grade. The strongest explanatory variable was in all cases one of the quizzes, although peer assessments were also significantly related to the final exam grade.

Moreover, the correlations between the number of assessment attempts (Quizzes, self-assessment, peer assessment) and the final-exam grade were moderate to low (between r= .26 and .41). This means that there seems to be a weak relationship between the number of assessments students took and their final exam grade. This finding contradicts other MOOC research that finds a strong positive relationship between the number of student activities and their final course grade (DeBoer et al. 2014).

Table 3. Stepwise regression analyses with final exam as dependent variable (*B* coefficients, standard errors (SE) and proportion explained variance (R^2 change))

	MOOC 1 EU Law 2013		MOOC 2 Terrorism 2013		MOOC 3 Terrorism 2014	
	B (SE)	R^2 change[1]	*B* (SE)	R^2 change[2]	*B* (SE)	R^2 change[3]
Weekly quiz 1	1.08 (0.26)	0.04	n.s.		n.s.	
Weekly quiz 2	0.82 (0.20)	0.03	0.91 (0.25)	0.20	1.06 (0.32)	0.02
Weekly quiz 3	n.s.		0.56 (0.15)	0.04	n.s.	
Weekly quiz 4	1.43 (0.22)	0.28	n.s.		n.s.	
Weekly quiz 5	n.a.		0.58 (0.22)	0.01	1.10 (0.26)	0.17
Peer grading 1	0.31 (0.03)	0.08	0.10 (0.04)	0.01	0.25 (0.06)	0.09
Peer grading 2	n.a.		0.17 (0.02)	0.10	0.12 (0.03)	0.03
Self-grading 1	n.s.		n.s.		n.s.	
Self-grading 2	n.a.		n.s.		n.s.	
Adjusted R^2	0.41		0.35		.30	
Degrees of freedom	4, 379		5, 475		4, 414	

n.a.= not applicable; n.s.= not significant with α=0.05
[1] Entered with the following sequence: Weekly quiz 4, Peer assignment 1, Weekly quiz 1, Weekly quiz 2
[2] Entered with the following sequence: Weekly quiz 2, Peer assignment 2, Weekly quiz 3, Weekly quiz 5, Peer assignment 1
[3] Entered with the following sequence: Weekly quiz 5, Peer assignment 1, Peer assignment 2, Weekly quiz 2

In MOOC 3, students could sign up for a certification track, which required completion of all quizzes, self- and peer assessments and final exam in time. Student who registered for a certification track received significantly higher scores on their final exam, compared to the other students ($M_{certification\ track}$ = 19.2 and $M_{other\ students}$ = 17.1; (t(574.5) = 7.41; p<.001)). We repeated the regression analyses for students following a certification track and the other students separately. The results are presented in Table 4.

From Table 4 it is clear that the assessments explained more differences between students in final exams score in cases that they followed a certification track: the first two quizzes, both peer assessments and the first self-assessment significantly explained differences in the final exam scores. For the other students, the total amount of variance in the final exam score explained by the other assessments is less compared to the students from the certification track.

6. Discussion and conclusion

In general, the quality of both the self-assessment and the peer assessment appeared to be moderate to high. These assessments showed a homogenous structure – and therefore a high reliability-, but the correlations between peer assessments of the same assignments were low to moderate. The latter means that peers did agree on their grades for the assignments only to a limited degree. The correlations between the various peer assessments of the last MOOC were moderate to high. In this MOOC, the procedures and criteria for peer assessment were adapted on the basis of the 2013 run. Moreover, there is only a weak correlation between self-assessment and peer assessment, and the correlations between different self-assessment assignments are higher than the correlations between self-assessment and peer assessment of the same assignments. In addition, self-assessments did not significantly explained variance in students' final exam scores. This suggests a bias of self-assessments and led us to conclude that self-assessments might not be a valid way to assess students' performance in MOOCs. Yet the weekly quizzes and both peer assessments significantly explained differences in students' final exam scores, with one of the weekly quizzes as the strongest explanatory variable

in all three MOOCs. Finally, the number of assessment attempts of students did not significantly correlate with their final exam scores. The latter result does not confirm conclusions from earlier research that found a strong positive relationship between the number of student activities and their course grade (DeBoer et al. 2014).

Table 4. Stepwise regression analyses with final exam as dependent variable for students following the certification track and the other students in MOOC 3 (*B* coefficients, standard errors (SE) and proportion explained variance (R^2 change))

	Certification track		Other students	
	B (SE)	R^2 change[1]	*B* (SE)	R^2 change[2]
Weekly quiz 1	1.34 (0.38)	0.07	n.s.	
Weekly quiz 2	1.42 (0.39)	0.22	n.s.	
Weekly quiz 3	n.s.		n.s.	
Weekly quiz 4	n.s.		n.s.	
Weekly quiz 5	n.s.		1.87 (0.31)	0.18
Peer grading 1	0.20 (0.09)	0.11	0.27 (0.08)	0.07
Peer grading 2	0.10 (0.04)	0.02	0.11 (0.04)	0.02
Self-grading 1	0.26 (0.10)	0.02	n.s.	
Self-grading 2	n.s.		n.s.	
Adjusted R^2	0.42		0.27	
Degrees of freedom	5, 157		3, 256	

n.s.= not significant with α=0.05

[1] Entered with the following sequence: Weekly quiz 2, Peer assessment 1, Weekly quiz 1, Self-assessment 1, Peer assessment 2

[2] Entered with the following sequence: Weekly quiz 5, Peer assessment 1, Peer assessment 2

With this study we provided insight in the quality of the various assessments in MOOCs and how these are related to the final exams. We conclude that self-assessments and peer assessments should be improved if they are used as summative indicators of one's achievements (assessment *of* learning). In the current MOOCs, they only can be used for self-reflection and peer feedback, emphasizing the formative function of assessment (assessment *for* learning). Of course, we should be careful with generalizing this insight to other types of MOOCs. The MOOCs of the current study can be classified as xMOOCs with a mixture of traditional course pedagogy of transferring knowledge from the lecturer to the student and more connectivist ideas of student interaction and peer assignments. Future research might go deeper into the quality of assessment assignments of different kinds of MOOCs including both assessment *of* learning and assessment *for* learning.

However, we agree with DeBoer et al. (2014) that we also should reconceptualise educational variables in research on MOOCs. Differences between traditional classroom data and MOOC data refer to the magnitude of data gathered in terms of numbers of registrants per course, observations per registrant and type of information, the diversity of registrants in reasons for registration as well as in their background, and the registrant use of course tools which is asynchronous and relatively unrestricted in sequence (DeBoer et al. 2014). These authors suggest a reconceptualization of enrolment in MOOCs (e.g., based on registration, course activities, course assignments and assessment, or final exam), participation (the authors show 20 participation metrics which are linked to students' general attendance, their clicks, the hours they spent on course activities, and the assessments), curriculum (curriculum activities showing a variability in sequence), and achievement (which can be based in various indicators of performance and participation). In order to understand the relationship between assessments, final grades and learning activities in MOOCs we have to think thoroughly

what kind of metrics for achievement should be used, how we should define enrolment and participation, in what way the curriculum is implemented, and –therefore- how assessments should be applied.

References

Admiraal, W., Huisman, B., & Ven, M. van de (2014) "Self- and peer assessment in Massive Open Online Courses", *International Journal of Higher Education*, Vol 3, No 3, pp 119-128.

Admiraal, W.F., Lockhorst, D., Wubbels, T., Korthagen, F.A.J. and Veen, W. (1998) "Computer-mediated communication environments in teacher education: computer conferencing and the supervision of student teachers", *Learning Environments Research*, Vol 1, No 1, pp 59-74.

Bates, T. (2014) "Comparing xMOOCs and cMOOCs: philosophy and practice", *Online Learning and Distance Education Resources*. Available at: http://www.tonybates.ca/2014/10/13/comparing-xmoocs-and-cmoocs-philosophy-and-practice/ [Accessed 15 February 2015].

Bayne, S., and Ross, J. (2013) "The pedagogy of the Massive Open Online Course: the UK view", York, UK: The Higher Education Academy.

Bell, F. (2010) "Connectivism: Its place in theory-informed research and innovation in technology-enabled learning", *The International Review of Research in Open and Distance Learning*, Vol 12, No 3, pp 98-118.

Bulfin, S., Pangrazio, L. and Selwyn, N. (2014) "Making 'MOOCs': The construction of a new digital higher education within news media discourse", *The International Review of Research in Open and Distance Learning*, Vol 15, No 5, pp 290-305.

Clarà, M. and Barberà, E. (2014) "Three problems with the connectivist conception of learning", *Journal of Computer Assisted Learning*, Vol 30, No 3, pp 197-206.

Clark, D. (2013) "MOOCs: taxonomy of 8 types of MOOC", Available at: http://donaldclarkplanb.blogspot.com.es/2013/04/moocs-taxonomy-of-8-types-of-mooc.html [Accessed 15 February 2015].

Daniels, J. (2013) "MOOC to POOC: Moving from Massive to Participatory" *JustPublics@365.* Available at: http://justpublics365.commons.gc.cuny.edu/2013/02/05/mooc-to-pooc-moving-from-massive-to-participatory/ [Accessed 29 May 2014].

DeBoer, J., Ho, A. D., Stump, G.S. and Breslow, L. (2014) "Changing 'course': reconceptualizing educational variables for Massive Open Online Courses", *Educational Researcher,* Vol 42, No 2, pp 74-84.

Ebben, M. and Murphy, J.S. (2014) "Unpacking MOOC scholarly discourse: a review of nascent MOOC scholarship", *Learning Media and Technology*, Vol 39, No 3, pp 328-345.

Harris, J. and Hofer, M. (2009) "Grounded tech integration", *Learning & Leading with Technology,* September/October pp 23-25, Available at: http://www.learningandleading-digital.com/learning_leading/20090910/#pg24 [Accessed 30 May 2014].

Hashmi, A.H. (2013) "HarvardX set to launch second SPOC", *Harvard Crimson*. Available at: http://harvardx.harvard.edu/links/harvardx-set-launch-second-spocharvard-crimson-amna-h-hashmi-september-16-2013 [Accessed 29 May 2014].

Hew, K.F. and Cheung, W.S. (2014) "Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges", *Educational Research Review*, Vol 12, No 1, pp 45-58.

Hill, P. (2013) "Emerging student patterns in MOOCs: A (revised) graphical view", *e-Literate*. Available at: http://mfeldstein.com/emerging-student-patterns-in-moocs-arevised-graphical-view/ [Accessed 12 September 2013].

Jaschik, S. (2013) "Feminists challenge Moocs with Docc", *Times Higher Education*. Available at: http://www.timeshighereducation.co.uk/news/feminists-challenge-moocswith-docc/2006596.article [Accessed 29 May 2014].

Kop, R. (2011) "The challenges to connectivist Learning on open online networks: Learning experiences during a Massive Open Online Course", *International Review of Research in Open and Distance Learning and Instruction*, Vol 12, No 3, pp 74-93.

Liyanagunawardena, T.R., Adams, A.A. and Williams, S.A. (2013) "MOOCs: A systematic study of the published literature 2008-2012", *The International Review of Research in Open and Distance Learning,* Vol 14, No 3, pp 202–27.

Milligan, C., Littlejohn, A. and Margaryan, A. (2013) "Patterns of engagement in connectivist MOOCs", *Journal of Online Learning and Teaching*, Vol 9, No 2.

Paulsen, M.F. (1995) "Moderating educational computer conferences", In Z.L. Berge & M.P. Collins (Eds.), *Computer-mediated communications and the online classroom* (Vol. III; pp. 81–103). Cresskill, NJ: Hampton Press.

Reeves, T. (1996) "Evaluating what really matters in computer-based education". Available at:: http://www.eduworks.com/Documents/Workshops/EdMedia1998/docs/reeves.html#ref10 [Accessed 30 May 2014]

Reilly, E.D., Stafford, R.E., Williams, K.M. and Corliss, S.B. (2014) "Evaluating the validity and applicability of automated essay scoring in two massive open online courses", *The International Review of Research in Open and Distance Learning*, Vol 15, No 5 , pp 83-98.

Rodriguez, C. O. (2012) "MOOCs and the AI-Stanford like courses: Two successful and distinct course formats for Massive Open Online Courses", *European Journal of Open, Distance, and E-Learning*, Available at: http://www.eurodl.org/?p=archives&year=2012&halfyear=2&article=516 [Accessed 15 February 2015].

Rodriguez, O. (2013) "Two distinct course formats in the delivery of connectivist moocs", *Turkish Online Journal of Distance Education*, Vol 14, No 2, pp 66-80.

Tattersall, A. (2013) "Gold rush or just fool's gold - A quick look at the literature", *ScHARR MOOC Diaries*. Available at: http://scharrmoocdiaries.blogspot.co.uk/2013/07/scharr-mooc-diaries-part-xvii-gold-rush.html [Accessed 29 May 2014].