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Look who's talking: Exploring instructors' contributions to Massive Open Online Courses

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Abstract
Previous research on xMOOC pedagogy has established that learner interactions in discussion forums play a fundamental role in learning. However, little is known about the extent to which MOOC instructors engage with learner conversations and the impact this has on learner engagement. Adopting a novel design, this study went beyond self-reported methods, and combined transcript analysis and in-depth interviews to examine the dynamics of learner-instructor interactions and to revisit the use of the Community of Inquiry framework (CoI) in MOOC context. The findings revealed that the majority of instructors' contributions to learner conversations are social, followed by teaching and cognitive contributions. While all contribution types decreased over the duration of the MOOC, the relative importance of each type did not necessarily change. Furthermore, the analysis showed that learners engaged with 42% of instructor contributions by responding to or liking them or both. Considering the application of the CoI to massive and open online learning contexts, this study demonstrates that whilst the framework can unfold educational transactions in MOOCs, re-operationalisation and re-conceptualisation of some indicators along with the introduction of new indicators are essential. The implications of this for theory and practice are discussed.

Keywords: Massive Open Online Courses (MOOCs), MOOC instructor, Community of Inquiry (CoI)

Introduction
MOOCs have attracted the attention of both the public and higher education institutions globally by emphasising cross border education, offering the potential for democratising education (Siemens, 2013), and supporting lifelong learning (Blackmon, 2016). They have enabled increased participation and the mobility of learners, educators and institutions (Maringe and Sing, 2014; Varghese, 2015). They support formal, informal, vocational and self-directed learning by allowing access to online content, be this to satisfy personal interest or obtain skills (de Freitas *et al.*, 2015). However, despite the growing number of MOOCs, the research in some aspects of these courses, such as teaching and instructors, has fallen behind. In 2014 and 2015, several studies and systematic reviews highlighted the absence of focus on instructors in MOOC research (Ross *et al.*, 2014; Stephens-Martinez *et al.*, 2014; Raffaghelli *et al.*, 2015). Furthermore, most recent studies, such as Zhu *et al.* (2018), and Blackmon (2018) still show little research in this area, despite the key role instructors play in learning (Cohen and Holstein, 2018; Hew, 2018). Therefore, this article aims

Structured practitioner notes
What is already known about this topic
- Most systematic reviews of MOOC research establish that there is a lack of focus on instructors and their practices in MOOCs.
- The CoI survey instrument has been evaluated for the MOOC context, and the framework has been used to investigate learner but not instructor activities in MOOC discussion forums.
- Among the three types of learner-content, learner-learner and learner-instructor interactions, the latter is low in MOOCs.

What this paper adds
- It identifies the level and types of instructors' engagement with large numbers of culturally and educationally diverse learners in MOOC discussion forums.
- It provides important insight into the extent and types of learners' engagement with instructor contributions in discussion forums.
- It proposes re-operationalisation and re-conceptualisation of some CoI indicators in addition to introducing new indicators for the use of this framework in MOOC contexts.

Implications for practice/policy
- The findings have broad use to teaching at large scale and enhancing MOOC instructor understanding of managing discussion activities more effectively.
- It reveals the learner and instructor activities in MOOCs that the CoI does not account for, and the way the framework and its scope can be enhanced.

to address this gap by focusing on instructors and their roles in learning and identifying the type and level of their contributions in MOOCs, particularly in discussion forums where they interact with learners. As Wise and Cui (2018:238) emphasise, 'to understand the impact of instructor activity on learner participation in discussion forums, it is important to consider not just if or how much the instructor participates, but the ways in which they do it'. To this end, the Community of Inquiry framework is used to understand instructor activities. We believe this will a) move forward research into instructor practices in MOOCs, b) provide insight into facilitation of learning and empowers instructors' practice, and c) raise the awareness of future instructors and course designers to plan discussions more effectively to support learning. Moreover, our research will advance the theoretical understanding of the CoI framework, and will provide evidence to expand its application to massive and open educational contexts.

Background
MOOCs
MOOCs are often characterised as cMOOCs or xMOOCs depending on their pedagogical underpinnings (Cui and Wise, 2015). In connectivist (c)MOOCs, the concept of a course is modified to non-linear, decentralised and self-directed learning through networked interactions. xMOOCs, in contrast, follow a cognitivist-behaviourist pedagogy where learners study the pre-prepared content, while having the opportunity to interact with peers and instructors in discussion forums (Margaryan *et al.*, 2015). However, as Ross *et al.* (2014) state, the cMOOC-xMOOC dichotomy is oversimplified and can lead to insufficiencies in describing the diversity of MOOC design and pedagogy. A good example of this are FutureLearn MOOCs, the focus of this study, which follow a social-constructivist pedagogy and emphasise social learning based on the Conversational Framework (Ferguson and Sharples, 2014). This model views learning as an active process of knowledge construction through conversations with self and others, where the

conversation forms around a topic goal. Teaching or facilitating learning is considered as supporting and managing these conversations (Laurillard, 2002).

In FutureLearn MOOCs, free-flowing discussion areas are provided alongside each course step to enable conversations. Conversations in each step are not connected to other steps (Swinnerton *et al.*, 2017), and as Chua *et al.* (2017) describe, discussions are in context rather than centralised to facilitate the Conversational Framework cycle. That is, learning activities allow learner-content interactions and facilitate learners' initial understanding of the content, whilst the discussions support in-group conversations, which help conceptions and misconceptions to emerge, and aid in negotiating shared understanding of concepts (Laurillard, 2012). Conversations in these MOOCs have a single hierarchical threading structure; i.e. initial posts are followed by a single thread of replies displayed chronologically (Tubman *et al.*, 2018). Additionally, the platform incorporates features such as replying, liking and bookmarking in discussions to enable learners' interactions and reflection.

Learner-Instructor conversations
Irrespective of MOOCs underling approach, interactions among learners, content and instructors are central to learning, and have been associated with learner engagement and satisfaction (Kop and Bouchard, 2011; Hew, 2018). Of the three interaction types: learner-content, learner-learner and learner-instructor, the latter plays a key role in fostering learner engagement in several ways. During a MOOC, once the subject matter becomes difficult or unfamiliar, learners' participation and contributions tend to decrease (Siemens *et al.*, 2015). In such situations, few learners feel confident in assisting other learners (Onah *et al.*, 2014), and learners have reported frustration as a result of receiving superficial or inadequate feedback from peers in the absence of instructors (Hew, 2018). This is when instructors' scaffolding is key to maintaining learners' engagement and facilitating learning (Kozan, 2016). Moreover, regardless of how self-regulated learners are in understanding the content, when application of knowledge is considered, they require an instructor's feedback to confirm whether they know areas of knowledge application, and whether they have applied the new knowledge correctly (Dolan, 2014; Chandrasekaran *et al.*, 2015). This 'reality testing' makes interaction with instructors particularly valuable (Moore, 1989). However, the context of MOOCs is important to consider; the scale and openness of MOOCs affects the extent and depth of conversations between learners and instructors due to skewed learner-instructor ratio (1,000:1) (Ferguson and Sharples, 2014:103). Consequently, these interactions are often low in number (Miyazoe and Anderson, 2013), and this can lead to increased transactional distance between the learners and instructors, and decreased learner performance and satisfaction (Moore, 2013). Thus, it is particularly important to explore the ways instructors support learning through their conversations with learners in MOOCs.

Community of Inquiry (CoI)
According to Garrison and Cleveland-Innes (2005), interaction is a complex concept, which must be understood in a comprehensive way. The CoI framework provides an exhaustive view of interaction by capturing the complexities of online educational transactions through three interdependent elements: social, teaching and cognitive presences (Garrison and Anderson, 2003). Cognitive presence focuses on the learning process and learners' development of higher-order thinking. Social presence reflects the development of interpersonal and purposeful relationships while teaching presence focuses on the design of educational experience before, and facilitation of learning during the course (Garrison *et al.,* 2000).

The core of CoI is cognitive presence, which is the extent to which learners are able to construct meaning through interaction and collaboration. It is operationalised through four (not necessarily linear) phases: the 'Triggering event' initiates the inquiry process and involves problem conceptualisation, and is followed by 'Exploration', where learners gather and exchange information to explore a topic. Through 'Integration', they synthesise this information for possible solutions, and in 'Resolution' they critically evaluate possible solutions and implement the best one (Garrison, 2009). Social presence, defined as the participants' ability 'to identify with the group or course of study, communicate purposefully in a trusting environment, and develop personal and affective relationships progressively by way of projecting their individual personalities' (ibid:352) plays a mediating role between cognitive and teaching presences. Teaching presence consisting of three constructs, represents the leadership dimension (Garrison and Akyol, 2013), and is associated with learners' perceived learning and satisfaction (Kop *et al.*, 2011; Arbaugh, 2014). Design and organisation deals with decisions about the course structure and learning process. Facilitating discourse is the key to providing support and guidance, and is essential for establishing and maintaining other presences. In direct instruction, more direct guidance is required to provide subject knowledge, diagnose misconceptions, or summarise the discussions (Garrison, 2017). Based on CoI, the purposeful collaboration among learners and instructors as participants of a learning community results in knowledge building, and a deep and meaningful educational experience occurs when learning communities actively seek personal meaning and mutual understanding (Garrison, 2016).

CoI is the most widely adopted explanatory educational framework for online learning, due to its comprehensive view of learning and its manageable application (Garrison and Akyol, 2013; Joksimović *et al.*, 2014). Within the MOOC context, it is mainly used to explore learners' activities; however, a few studies have also utilised it to examine instructors' practices. Watson *et al.* (2017) examined how social and teaching presences are established by six MOOC instructors to facilitate attitudinal change. Cleveland-Innes *et al.* (2016) designed a MOOC with three levels of teaching presence to identify the patterns of learner interactions when an instructor role moves from directive to facilitative. Thus, following Joksimović *et al.* (2015), and Amemado and Manca's (2017) call to assess the applicability of CoI for researching learning and teaching in large-scale contexts, this study applies the framework to unfold instructor activities in MOOCs by addressing three research questions:

1. To what extent do instructors contribute to conversations in MOOCs and how do their contributions change during a course?
2. How are instructor contributions in MOOCs characterised based on the Community of Inquiry framework?
3. To what extent, and in what ways do learners engage with instructor contributions?

The Current Study
This study examined 24 instructors' activities in discussion areas of three (three-week) FutureLearn MOOCs offered by a UK university (Table 1). To explore instructors' contributions to discussions, two approaches were brought together: the discussion transcripts were first analysed based on the CoI indicators, and then instructors were interviewed for additional insight. This combination of approaches provided a rich dataset to portray MOOC instructor activities. For the first phase, 818 out of 2,832 learner-instructor conversations (from a total of 29,788 posts by 10,943 participants) were selected using stratified random sampling (5% margin of error and Alpha of 0.05). To ensure representativeness, the strata included the conversation

length[1] (short, medium and long), timing (beginning, middle and end of a course) and instructor roles . FutureLearn defines three instructor roles: the *Lead educator,* an academic with specialist subject knowledge and responsible for several duties from leading the course design, interacting with learners to supporting mentors; *Educators* also instructors with course specialist knowledge, however, without leadership duties; *Mentors* by contrast, have a good understanding of the course subject with varying responsibility levels (e.g. teaching and course creation vs facilitating discussions only) (Thair, 2018). Nevertheless, these roles are practised differently in different MOOCs.

Table 1: Examined MOOCs

Course	No. of instructors	No. of participants	No. of posts	No. of learner-instructor conversations
MOOC1-History	7	3,270	12,340	666
MOOC2-Business	11	6,003	13,618	1,482
MOOC3-Arts	6	1,670	3,830	684

Assessing contribution level (volume)

Following Anderson's (2003) claim that participation in discussions can be measured by the frequency with which participants engage with the content or other participants, the total number of instructor comments, including both responses and initiating comments was considered to determine instructors' level of contributions. Although studies such as Epp *et al.* (2017) criticise quantifying participation due to the lack of focus on the content, the current study addressed this aspect by analysing the content of instructor comments. However, it was not possible to measure instructors' implicit engagement with conversations, as the platform does not provide click-based data or information about the number of comments instructors liked.

Assessing contribution type

Applying a directed content analysis, both instructor and learner comments were analysed based on the CoI indicators. Coding was not stopped at 'presence' or 'category' levels, as it would have limited insight in exploratory research (Garrison *et al.*, 2006). For learner comments, an additional category of 'learning presence' (Shea *et al.*, 2012) was considered to capture learners' self and co-regulated, activities. Given that MOOC design is different from traditional online courses, some CoI indicators required re-operationalisation (updating the operational definition) or reconceptualisation (changing the intended use and interpretation) of definitions. Additionally, when necessary, new indicators were introduced to code activities that the CoI does not account for. See the coding scheme here.

A 'comment' (i.e. everything included in one post) was considered as the unit of analysis to reduce decontextualisation of contributions and to enable objective identification. Following Anderson *et al.* (2001), multiple codes were allowed for a single comment, since often more than one topic was covered in a comment. The first author conducted the coding, and inter-rater reliability was computed using Krippendorff's Alpha. An independent trained coder coded 294 randomly-selected comments and the K-alpha of 0.79 at indicator level showed a good reliability level. Note that frequencies, percentages and magnitude descriptors are used to report the results of content analysis and enable comparison across CoI categories and instructor roles. However, they are not intended to quantify the analysis, and thus statistical significance testing is not appropriate.

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[1] 1-5, 6-10 and 11-16 comment conversations represent short, medium and long conversations respectively.

Assessing changes over time
To examine the changes over time, variations in the level and type of instructor contributions at three time segments, i.e. weeks 1, 2 and 3 were considered.

Assessing learner engagement with instructors' contributions
The number of learner replies to and learner likes of an instructor's contribution were used to identify four engagement behaviours: a) by both liking and responding, b) by responding, c) by liking an instructor's contribution and d) no engagement. Based on this classification, responding to an instructor's comment represents an explicit interaction between a learner and the instructor, and can signify a higher level of engagement compared to liking, which indicates an implicit interaction.

Instructor interviews
After examining the learner-instructor conversations, 12 instructors (3 lead educators, 5 educators and 4 mentors) were interviewed to understand their actions in discussions and their roles in supporting learning. Interviews were semi-structured (60 to 90 minutes) to accommodate both standard questions about instructor roles, and instructor-specific questions related to their conversations with learners. A modified version of Miles *et al.*'s (2014) coding procedure was applied to analyse interviews. The CoI indicators were used as pre-determined codes to enrich the findings from transcript analysis and for consistency between the two research phases. Nevertheless, the coding process was open to emerging codes to accommodate new variables.

Results
Instructors' level of contributions
Instructors contributed to just over half of the conversations that occurred in discussions. Analysis of the 818 conversations sampled found that 93% were short, 6% medium and 1% long (Table 2). A closer examination of short conversations revealed that they were largely two-comment exchanges (520/761, 68%). The analysis also showed a relative balance of participation by all instructor roles although mentors contributed the most.

Table 2: Overview of instructors' conversations

Instructor	Short conversations		Medium conversations		Long conversations		Total	
	N	%	N	%	N	%	N	%
Lead educators (n=3)	236	94%	11	4%	4	2%	**251**	**31%**
Educators (n=7)	236	90%	23	9%	3	1%	**262**	**32%**
Mentors (n=12)	289	95%	13	4%	3	1%	**305**	**37%**
Total	761	**93%**	47	**6%**	10	**1%**	818	100%

Instructors' type of contributions
Within the 818 conversations, instructors made 2,365 comments. The content of these instructors' contributions were coded into social (n=1326, 56%), teaching (n=938, 40%) and cognitive (n=101, 4%) presences (Table 3).

Table 3: Overall instructors' contributions

Instructor	Social Presence		Teaching Presence		Cognitive Presence	
	N	%	N	%	N	%
Lead educators	451	34%	319	34%	32	32%
Educators	300	23%	351	37%	39	38%
Mentors	575	43%	268	29%	30	30%
Total	1326	**56%**	938	**40%**	101	**4%**

Instructors' social contributions

Social contributions accounted for more than half of the instructors' contributions, and as Table 4 illustrates, they largely focused on group cohesion (88.5%). Phatic communications, greetings, and vocatives represented a clear majority, indicating that instructors used these cohesive devices in most contributions. In interviews, most instructors highlighted the importance of the cohesive aspect of their communications for humanising the MOOC, creating a feeling of mutual support and community and ensuring that the large number of comments did not discourage learner participation.

> *'Some of the comments were purely, "Hi, great to see you on board," this sort of thing, just to try and make that connection, just to show there's someone at the other end'. (LEd2)*

However, the weak evidence of 'Group Reference' to create a sense of community is noticeable, suggesting that the instructors often used simple cohesive behaviours such as greetings, yet did not take group cohesion to the next level by making 'group references'. As one of the educators mentioned, encouraging inclusivity was particularly important because of learner diversity in terms of their geographical and generational spread, knowledge, and language proficiency.

Only 9% of instructors' social contributions centred on creating an open and interactive environment for discussions. Affective and personal responses represented instructors' least common social postings (2.5%), which suggests that they do not tend to express their feelings or disclose information about themselves. Their use of humour associated with this category was also minimal.

Table 4: Instructors' social contributions

Social Presence	Lead-educators		Educators		Mentors		Total	
	N	%	N	%	N	%	N	%
Personal(affective) Communication	**18**	**4**	**12**	**4**	**3**	**<1**	**33**	**2.5**
Expressing Emotions	3	<1	4	1	0	0	7	<1
Use of Humour	5	1	2	<1	0	0	7	<1
Self-disclosure	10	2	6	2	3	<1	19	1
Open(Interactive) Communication	**53**	**12**	**33**	**11**	**33**	**6**	**119**	**9**
Asking questions (non-task)	4	1	4	1	3	<1	11	1
Quoting from others' messages	2	<1	2	<1	5	1	9	<1
Expressing agree/disagreement	11	2	4	1	3	<1	18	1
Complimenting and expressing appreciation	34	7	20	7	21	4	75	6
Support for communication*	2	<1	3	1	1	<1	6	<1
Group Cohesion	**380**	**84**	**255**	**85**	**538**	**94**	**1174**	**88.5**
Phatic, Greetings	148	33	105	35	249	43	502	38
Vocative	207	46	136	45	283	49	626	47
Group reference	25	5	14	5	7	1	46	3
TOTAL	**451**	**34**	**300**	**23**	**575**	**43**	**1326**	**100**

*new indicator

Instructors' teaching contributions
The second most frequent contributions were related to teaching presence (40%), and showed instructors facilitating the learning discourse (e.g. *So perhaps the next question is, how do you define the call of duty?*), providing direct instruction (e.g. *Yes - but the real combination she affected was between Stanislavsky and Laban. The result was a psychologically motivated movement vocabulary*) and overseeing course organisation (e.g. *The week starts with theory and we've chosen case studies to make learning interesting for all*).

As shown in Table 5, facilitating discourse comments comprised 43% of total teaching contributions and were prioritised over direct instruction. This suggests that instructors emphasise monitoring the discussions to build understanding. The most commonly used indicator within this category was 'acknowledging/encouraging learners' contributions'. Instructors in interviews emphasised that reassuring learners that their comments were recognised was intended to have affective impact on learners' engagement. The analysis also revealed that some facilitating discourse indicators, such as 'identifying agreement/disagreement' are not present in MOOCs.

Comments giving direct instruction were the second most common pedagogical contributions (38%), and manifested instructors' academic leadership in dealing with discussions. The most frequently used strategies were supplying clarifying and additional information, presenting questions and referring learners to outside materials. Conversely, there was no evidence of '(re)focusing discussions', since the concept of 'discussions' as defined in traditional online courses hardly exists in MOOCs. This is also applicable to 'summarising discussions', which occurred only rarely.

Comments related to the course design and organisation were instructors' least common teaching contributions (19%). They proved to be different in MOOCs due to the different course design and structure, and thus required some reoperationalisation and reconceptualisation of indicators. 'Design methods' for instance, not only encompassed instructions about participating in activities and completing the course, but also included information about late joiners, obtaining certificates and the re-run of a MOOC. Similarly, 'setting time parameters' mainly addressed course schedule rather than course deadlines. A more appropriate label for this indicator could be 'advising course timeframe'.

Table 5: Instructors' teaching contributions

Teaching Presence	Lead-educators		Educators		Mentors		Total	
	N	%	N	%	N	%	N	%
Design and Organisation	**71**	**22**	**59**	**17**	**46**	**17**	**176**	**19**
Setting curriculum	32	10	30	1	10	4	72	8
Design methods	21	7	6	2	17	6	44	5
Establishing time parameter	10	3	13	4	8	3	31	3
Utilising technology effectively	5	2	2	<1	4	1.5	11	1
Establishing netiquette							0	0
Making macro-level comments about course	3	1	5	1	2	1	10	1
Marketing the course or institution*	0	0	3	1	5	2	8	1

	Lead-educators		Educators		Mentors		Total	
Facilitating Discourse	**131**	**41**	**125**	**36**	**154**	**58**	**409**	**43**
Identifying areas of dis/agreement	0	0	0	0	2	1	2	<1
Seeking to reach consensus/understanding	4	1	13	4	8	3	25	3
Acknowledging, encouraging learners' contributions	111	35	78	22	86	32	275	29
Setting climate for learning	10	3	10	3	15	6	34	4
Drawing in participants, prompting discussions	6	2	24	7	43	16	73	8
Assessing the process efficacy							0	0
Direct Instruction	**117**	**36**	**168**	**48**	**68**	**26**	**353**	**38**
Presenting content/question	5	2	24	7	33	12	62	7
(Re)Focusing discussions							0	0
Summarising discussions	1	<1	2	<1	1	<1	4	<1
Confirming understanding through feedback	21	7	16	5	5	2	42	5
Supplying clarifying information	40	12	48	14	5	2	93	10
Supplying additional information*	32	10	51	15	12	5	95	10
Making explicit reference to outside material	18	7	27	8	12	5	57	6
TOTAL	**319**	**34**	**351**	**37**	**268**	**29**	**938**	**100**

New indicators

Instructors' cognitive contributions

Cognitive contributions accounted for only 4% of the overall contributions. The breakdown of these contributions (Table 6) indicated that most comments were associated with the exploration phase of inquiry (93%). Instructors specifically joined learners for 'exploration within the online community', where they supported or contradicted previous ideas.

Table 6: Instructors' cognitive contributions

Cognitive Presence	Lead-educators		Educators		Mentors		Total	
	N	%	N	%	N	%	N	%
Triggering Events	0	0	3	8	2	7	**5**	**5**
Exploration	31	97	34	87	28	93	**93**	**93**
Integration	1	3	2	5	0	0	**3**	**3**
Resolution							**0**	**0**
TOTAL	**32**	**32**	**39**	**39**	**30**	**30**	**101**	**100**

Amongst instructor roles, educators made the most teaching and cognitive comments, whilst their social contributions were the lowest compared to mentors and lead educators. Mentors' largest contribution was social with a nearly equal proportion of teaching and cognitive comments. The data also suggest that lead educators contributed roughly equally to all presences, although their cognitive presence was slightly lower than other presences (Table 7).

Table 7: Contributions based on instructor roles

Instructor	Social Presence		Teaching Presence		Cognitive Presence	
	N	%	N	%	N	%
Lead educators	451	34%	319	34%	32	32%
Educators	300	23%	351	37%	39	38%
Mentors	575	43%	268	29%	30	30%
Total	1326	**56%**	938	**40%**	101	**4%**

Newly emerged indicators

The new social indicator captures participants' attempts to resolve communication misunderstandings or to clarify their intended meaning, and helps towards creating conditions for open communication (*e.g. it might have come out wrong, but I was not trying to point out any "mistakes". What I was trying to say was exactly what you are saying*). Although CoI considers 'supplying clarifying information' under teaching presence, it only addresses clarifications about content with a direct instruction function and not the social aspect of communications. Therefore, comments that fulfil this function are coded into 'support for communication' and constitute 6% of learners' and 1% of instructors' open communications.

Within teaching presence, instructors also gave content-related information to provide learners with additional information about a topic or the content, rather than to reduce confusions or misconceptions. Therefore, a new indicator of 'supplying additional information' was added. Another new indicator situated within design and organisation was related to instructors' efforts to promote the institution and its courses (e.g. *Hope this course inspires you to come and study at X University*). These comments are coded into 'marketing the course or institution' and constitute 1% of instructor teaching contributions.

Changes to contributions over time

Instructors' contributions declined as the MOOCs progress. More than half of conversations (57%) occurred at the beginning of MOOCs, which was more than halved in the middle (26%) and reached its lowest level at the final week (17%).

As Figure 1 shows, instructors' cognitive comments did not decrease considerably, thus their relative importance increased modestly from the beginning to the end of courses. The social and teaching comments showed a contrary development pattern over time, which indicates an interaction between these two presences. The higher proportion of social presence gave way to instructors' teaching presence as the courses progressed. This was particularly noticeable from the beginning to the middle of a MOOC. However, towards the course end, this interaction was more evident between teaching and cognitive presences, since instructors' teaching presence decreased and their cognitive presence increased, while their social presence remained at the same level.
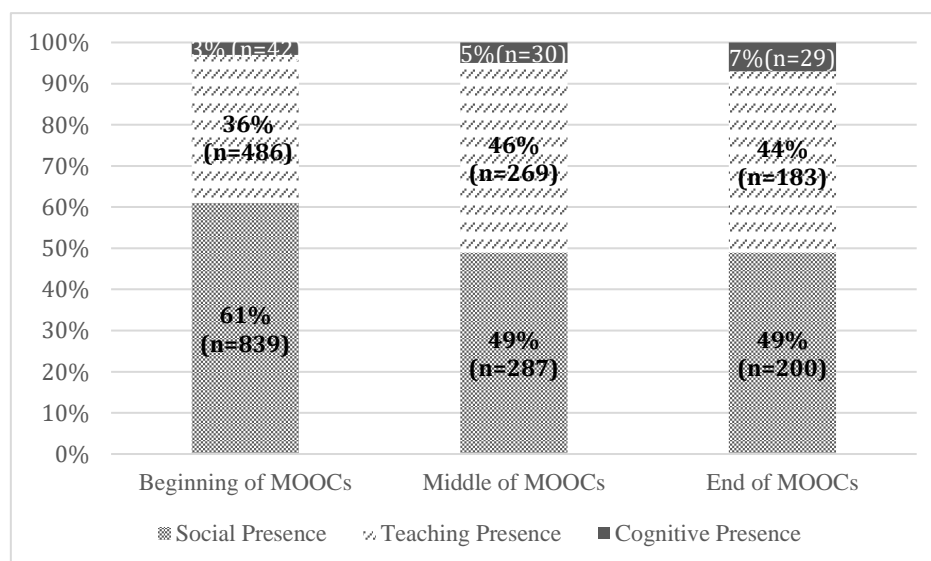

Figure 1: Instructors' contributions over time

Learner engagement with instructor contributions

Learners engaged with 42% of instructor contributions, having no engagement with 58%. As shown in Table 8, they responded to 15% of instructors' comments by both liking and replying to them, while they liked and responded to educators more than other instructors.

Table 8: Learners' engagement with instructors' contributions

Instructor	Liked and responded		Only Responded		Only Liked		No Engagement	
	N	%	N	%	N	%	N	%
Lead educators	38	34	26	32	31	25	139	32
Educators	48	42	36	44	45	38	110	25
Mentors	27	24	20	24	46	38	190	43
Total	**113**	**15**	**82**	**11**	**122**	**16**	**439**	**58**

Learners also replied without liking to 11% of instructor comments. Similarly to the previous category, learners responded to educators more than to other instructors. These two engagement types constituted learners' explicit interactions with instructors. When the content of 'liked and responded', and 'only responded' was compared, the domination of teaching indicators was noticeable in the former, whereas 'only responded to' contained a balance of social and teaching indicators. This suggests learners show a higher explicit engagement with instructors' comments that contain instances of teaching presence as the following examples show:

> *Great discussion, If I may add to it, I think it is both. Radical innovation for the automotive industry as Paul mentions, but possibly disruptive for the petrol industry.*
> *(7 likes, 6 replies)*

> *Hi Nicola, perhaps the following can be of assistance to you.* http://www.forbes.com /sites/timworstall /2014/04/20/
> *(6 likes, 5 replies)*

> *Hi Tom - Good question - both the Japanese and Chinese traditional theatres were of real importance for Meyerhold. I (and others) have written particularly about jo, ha, kyu from Noh and its similarity to the acting cycle of intention, action and end-point. The key constant is the level of stylisation in these forms, as he saw it*
> *(11 likes, 2 replies)*

Learners also engaged implicitly with instructors' contributions by 'only liking' them (16%), while liking educators' and mentors' postings equally and at a higher level than lead educators' contributions.

Learners did not engage with 58% of instructors' comments. Mentors' comments were the least attractive to learners. When the content of these comments is considered, they show nearly the same combination as 'only liked' postings. Nevertheless, there was a nuanced difference; in addition to cohesive responses, 'only liked' comments included a high number of open communication responses when they co-occurred with teaching-presence indicators.

Discussion and Conclusions

This study provides a greater understanding of instructor contributions to MOOCs by going beyond instructors' motivation and experiences of delivering a MOOC and examining the type and level of their contributions to discussions, while also studying the learner engagement with these contributions.

Our analysis indicates that social postings comprise a clear majority of instructor contributions and that they are predominantly related to group cohesion consistent with findings of Watson *et al.* (2016). However, the predominance of this category is largely due to greetings and vocatives, and not group references. This shows instructors do not expand group cohesion to the group level, but restrict it to individuals, most likely because of the learners' massive number, diversity, and varying interests, and the short course duration. Garrison (2016:48) discusses a lack of 'meaningful coherent learning community' in MOOCs due to learners' self-regulation; however, as this study shows, it can also be attributed to instructors' inability to create a sense of community. Another possible explanation can be cross-cultural conversations in MOOCs where learner diversity led to the emergence of the new social indicator that deals with communication misunderstandings. Little awareness of different communication patterns and cultures can lead to misunderstanding and inhibit community formation (Rovai, 2007). 'Learning crowds' or 'network of learners', which are more flexible in entrance and exit of members (Anderson, 2017) may better reflect the group dynamics in MOOCs. Instructors' use of personal communications within social presence, unlike Watson *et al.*'s (2017) study, was very low and this suggests a lack of engagement with the interpersonal aspect of conversations. Learners' rating of social presence in Poquet *et al.* (2018) investigation support this finding.

Learners' implicit or no engagement with instructor comments that included a high level of social indicators is the most important finding about instructors' social contributions. This may be because these contributions do not meet content-related and social needs of learners together (Hofmann and Mercer, 2016). Social contributions mainly promote participation, whereas if the level of teaching and social indicators are balanced, contributions will encourage both participation and meaningful learning.

Instructors' teaching contributions primarily focused on facilitating the learning discourse similar to Watson *et al.*'s (2017) study, which demonstrates a shift from a leading to a facilitating role. This suggests MOOC learning discourse supports and guides thinking rather than challenges it (Clarke and Bartholomew, 2014). Some facilitating strategies (e.g. identifying dis/agreements) occurred only rarely, most likely because of the MOOC scale. Other strategies such as 'reaching consensus or understanding' lost their group and collective sense and operated at an individual level. Conversely, the collaborative dynamics of team teaching in MOOCs led to a new facilitating strategy where instructors direct learners to other instructors or bring a learner's comment to the attention of other instructors. This reflects the dividing of responsibilities, according to expertise, such that each instructor is responsible for a part of the course. McAuley *et al.* (2010) uses 'partnership of facilitators' where each partner brings a particular expertise or skill to teaching partnership. Taken together, this demonstrates how facilitating learning is different in MOOCs.

Contributions giving direct instructions constituted a much smaller proportion of instructor comments and mainly provided learners with additional or clarifying information about the content. According to Clarke and Bartholomew (2014), a balance of direct instruction and facilitation is required to move learners through the inquiry process; however, as this study showed, similar to Watson *et al.* (2017) this balance was not evident in MOOCs. The end of some indicators' lifespan within direct instruction was also apparent. There were no occurrences of 'summarising discussions' and little '(re)directing discussions' due to the nature and structure of MOOC discussions. Comments related to course design and organisation were particularly rare, since non-teaching members classified as 'hosts' were responsible for dealing with those. This is again a result of team teaching and therefore distributed teaching presence in MOOCs. Interestingly, instructors were engaged in a new aspect of course organisation, i.e. marketing

their institution, since MOOCs are often used for publicity and marketing to increase visibility and recruitment (Howarth *et al.*, 2017). This new indicator reflects a unique aspect of course organisation in MOOCs.

From a theoretical standpoint, our study confirmed Anderson's (2017) claim that the CoI framework is robust enough to reveal and explain educational conversations in an intercultural and massive context such as MOOCs. All the CoI categories cross easily to MOOC social-constructivist pedagogy; however, six indicators required reconceptualisation and reoperationalisation and three indicators needed to be introduced to enable understanding of MOOC instructor activities and to unfold the dynamics of learner-instructor interactions. Nevertheless, the challenge of creating discussion areas that 'support focused synergy of minds through communication and commitment to a common interest and purpose' (Garrison 2016:8) remains, as interests and purposes of MOOC learners are diverse (de Freitas *et al.*, 2015). Therefore, Dron and Anderson's (2014) suggestion of learning in 'sets' where learners with an interest in a topic but no appeal for developing a closer group or community can be better for learning in MOOCs.

Although the CoI required some adjustments in the context of MOOCs, it provided a crucial and powerful lens to explore MOOC instructor activities. It also enabled us to understand the different nature of the three presences and the way scale and openness can affect them. The revised model developed and used in this study will inform future research into learning and teaching in MOOCs and other massive contexts. Moreover, the findings will serve as a reference point for current and future MOOC instructors to evaluate the balance of presences in their contributions while recognising the type of comments that learners engage with most. Furthermore, findings about learners' engagement with instructor contributions will provide a means by which course designers can reflect on where and when to devise discussion areas to maximise learner engagement. One practical implication of these findings is that instructors should focus more on teaching presence in their contributions as it seems learners engage with such contributions more. Moreover, considering little learner engagement with instructor social contributions, we suggest instructors focus on those less.

In sum, the present study offers several contributions to knowledge and practice.. The findings provide useful insights into patterns of instructors' contributions to MOOC discussions and enable MOOC instructors to make research-informed decisions about their activities in forums. The greater understanding about learners' engagement with instructor contributions highlights how some instructor activities are more engaging while others (e.g. social) could be reconsidered to facilitate a more fruitful learning discourse.

Limitations and Future Research
Although the sample size in this study is appropriate and representative of learner-instructor interactions in FutureLearn MOOCs, a number of limitations should be mentioned. First, the study focused on MOOCs from one institution and one platform. Further research replicating these results in MOOCs offered through other platforms will enhance the generalisability of our findings. Second, only platform data were considered for exploring learner-instructor conversations. Future studies could benefit from other data sources such as learner- instructor conversations outside the platform (e.g. Twitter). Third, this study did not attempt to quantify the findings statistically, as the content analysis of conversations is used to explore and not predict instructors' and learners' engagement behaviours. Quantitative statistical analysis could be included in future research.

Statements on open data, ethics and conflict of interest

Ethics approval was received from University of Leeds, AREA Research Ethics Committee (Ref. AREA15-119). Informed consent was obtained from MOOC instructors. Data have been anonymised and no participant is identifiable in this paper.

There is no potential conflict of interests related to this study. Any anonymised data will be available upon request.

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