

# Networked pedagogy: Exploring asymmetries in the structuring of distributed learning networks

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## Abstract

The conclusions drawn from network science regarding the asymmetric structuring of real-world networks offer important theoretical orientation in addressing the shifting pedagogical topography of distributed learning networks. Problematizing the development of learning theory and pedagogy surrounding networked learning in this regard, this analysis develops an empirical case study of the actors and processes contributing to the structuring of a distributed learning network. Despite finding a highly-connected core of facilitators and participants, course facilitators maintain the greatest influence within the learning network. Further analyses detail the relationships between this core group of actors and asymmetries of media production, interactivity, and network expansion. These findings inform theoretically-directed discussion of networked pedagogy.

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## 1 Introduction

A happy ignorance pervades learning theories and research directed to the expansive and complex networks that now characterize formal and informal learning opportunities for millions of people worldwide. Sensitive to changing conditions of knowledge construction, networked learning theories including connectivism (Siemens, 2005), the theoretical underpinning of many Massive Open Online Courses (MOOCs), have yet to engage issues preoccupying network and information science for nearly fifteen years. Specifically, awareness of the structural asymmetries of networks, spurred by research finding similar, highly-skewed architectures across real-world networks (Barabási & Albert, 1999), has not yet oriented analysis of the complex patterning of learning networks. This awareness, in turn, recommends a re-evaluation of what pedagogy means in the context of networked learning.

As Dohn (2014) describes, networked learning involves information and communication technologies “used to promote connections: between one learner and other learners; between learners and tutors; between a learning community and its learning resources; between the diverse contexts in which the learners participate” (p. 30). The question of structural asymmetry invites new consideration of pedagogy as a connective function that de-centers teaching theory and practice from an exclusive focus on the directive actions of individual teachers, and instead asks how teaching functions are distributed among peer learners and technologies as a result of the structural effects of network topologies. The concept of “networked pedagogy” seeks to orient networked learning theory in this direction.

This paper begins this reorientation by evoking the changing discussions of pedagogy that technologically-mediated networks have inspired in order to suggest a burgeoning oversight of structural asymmetries that stand to condition networked learning practices and complicate the understanding of flexibility, diversity, and openness digital learning networks are generally held to offer. Toward this end, an empirical analysis of a distributed learning network, *MOOC MOOC: Critical Pedagogy*, premises and enriches a theoretical consideration of what becomes involved when talk shifts to a networked pedagogy sensitive to the performative effects of asymmetry in learning networks.

## 2 Pedagogy in Networked Learning

To search for a networked pedagogy begins with the classic model of community inquiry that has hitherto oriented pedagogy and design for online learning. Garrison, Anderson, and Archer (2001) outline three elements- cognitive presence, social presence, and teaching presence- required for educational experience. In this model, learning emerges in the mediated yet closed community of teachers and students in which three teaching functions are required: one a priori, the design of course content and activities while the second, facilitation of discourse, and third, direct instruction, enable pedagogical control over the course (Anderson, Liam, Garrison & Archer, 2001).

Technological networks supporting distributed learning communities alter this pedagogic configuration (Dohn, 2014). Instead the teaching function shifts to facilitate self-directed learning based in the learner's capacity to develop networks (Ross, et al., 2014; Siemens, 2005). Articulations include McLoughlin and Lee's (2011) "Pedagogy 2.0," featuring practices of personalization, participation, and productivity "that favor learner choice and self-direction" (p. 51), or Blaschke's (2012) "net-centric" outline of heutagogy (a pedagogy of self-determined learning) where the teacher "fully relinquishes ownership of the learning path and process to the learner" (p. 59). These pedagogic approaches to networked learning see the teaching function move from a unitary authority and context to facilitation of multiple, learner-directed networks.

Research in networked learning has in turn sought a teaching function that is dispersed, multiple, and coextensive with the practices of a learning community (Ross, et al., 2014). As a result, the teaching function becomes a role anyone, from teachers to learners themselves, might assume and exercise through practices "exert[ing] influence over the network" (Skrypnik et al., 2015, p. 209). Skrypnik et al., (2015) provide important findings in this respect, observing a teaching function distributed across traditional instructors, emergent learner-facilitators, as well as technological actors such as hashtags that direct Twitter-based course discussions.

Despite the important contributions of this research, the increasing distribution of teaching functions has not been considered in light of growth patterns organizing asymmetries within sociotechnical networks, or that such patterns might decisively structure processes of networked learning. Pulling conceptual orientation from network science forces open the relationship between network structure and the evolution of its growth (Barabási, 2009). Critical analysis of the conditions of growth in learning networks becomes imperative, and potentially significant to the articulation of mechanisms constituting emergent networked pedagogies.

Beginning such an analysis recommends exploring the extent to which pedagogic influence, observed through specific patterns of connectivity, becomes unevenly dispersed among teachers or facilitators, peer learners, and technological actors. The processes and effects of structural asymmetry might then be analyzed as (re-)constituting the teaching function of distributed learning networks. Consequently, the following questions orient a case study of networked learning: (1) What actors emerge to positions of influence, and how is influence dispersed within the learning network? (2) What patterns can be observed across these actors' practices? (3) How might the observed influence distributions and patterns of practice structure the growth and function of learning networks?

### 3 Case Study of *MOOC MOOC: Critical Pedagogy*

Active six weeks between January and February 2015, *MOOC MOOC: Critical Pedagogy* (MMCP) was organized to foster a networked learning community focused on discussing and employing critical pedagogies in traditional and online learning contexts. The course centered on hashtag-based Twitter discussions and personal blog composition directed toward community critique and discussion of foundational pedagogic texts such as Freire's *Pedagogy of the Oppressed*. Each week the facilitators of the course, editors of the online journal *Hybrid Pedagogy*, indicated a primary reading and facilitated live hashtag chats.

As a distributed network, participants looked to the facilitators at *Hybrid Pedagogy* for initial organization but were free to interact and share with whom they pleased regarding media content that was both planned by organizers and emergent to the network. As such MMCP represents a prime example of distributed learning networks in which pedagogical functions remain formally minimal and dispersed throughout the networking practices of the learning community.

Networked learning theory orients this analysis in recognizing learning as a social activity emerging through an ongoing process of situated and embodied practice (Dohn, 2014, p. 35). In this respect, network learning draws on community-centered, participatory theories of learning such as Lave and Wenger's (1991) situated learning theory. Furthermore, concerned with heterogeneous networks established and maintained through information and communication technologies, networked learning regards learning and knowledge as a materially-embodied, sociotechnical accomplishment (Thompson, 2012). Oriented accordingly, (social) network analysis provides a suitable methodological approach (Haythornthwaite & de Laat, 2012; Skrypnik et al., 2015).

The MMCP network evolved during eight stages: pre- and post-course periods framing the six active weeks of the course. Across these stages 485 unique participants contributed to discussions on Twitter under the course hashtag #MMCP, contributing 4632 unique tweets and 2770 retweets. Throughout the duration of the course participation consistently decreased with a height of 1185 tweets and 717 retweets in week one to only 446 and 312 respectively in week six. Actor participation decreased as well,

with 125 participants involved during week one and 41 during the final week. After week two the percentage of new actors joining the network averaged around 26% of the total weekly participants.

In order to identify influential actors in MMCP, hub and authority measures were conducted for each actor's Twitter mentions across each stage of the course. Network hubs and authorities are eigenvector-based generalizations that describe the distribution of nodal links as structures respectively conferring and performing authority in a network (Kleinberg, 1999). Thus, "a good *hub* is a page that points to many good authorities; a good *authority* is a page that is pointed to by many good hubs" (p. 611). The hub value of a node extends from the authority values of connected nodes in directed, out-going ties, while authority value is proportional to the hub scores of nodes connected by incoming links. The resultant link structures indicate the way network patterns of actors (hubs) *commonly* recognize salient or influential members (authorities) of a networked community. To analyze hubs and authorities of the MMCP network that developed through the Twitter hashtag #MMCP, link measures were taken of tweets mentioning other peer learners (out degree) and mentions received from others (in degree).

Figure 1 presents a graph of the total hub and authority scores for the five most prominent facilitators and participants in the network. As both groups participate in course discussions, their comparison addresses how influence is distributed between the formal organizers of the course and participants contributing to its open design. Analysis of the learning network reveals that the hub and authority scores of facilitators consistently rank higher than participants, indicating that facilitators interacted often with authorities in the network (hub score), while also receiving the most mentions in Twitter discussions (authority score). The scores of the top 10 actors, both facilitators and participants, are also visualized. The high scores across each stage of the course reflect the prominence of these actors and the disparity of interaction between the latter and less influential members of the network. This is additionally demonstrated by the hub and authority scores of new entrants to the network. These actors remain marginal participants compared to the core of highly-connected actors.

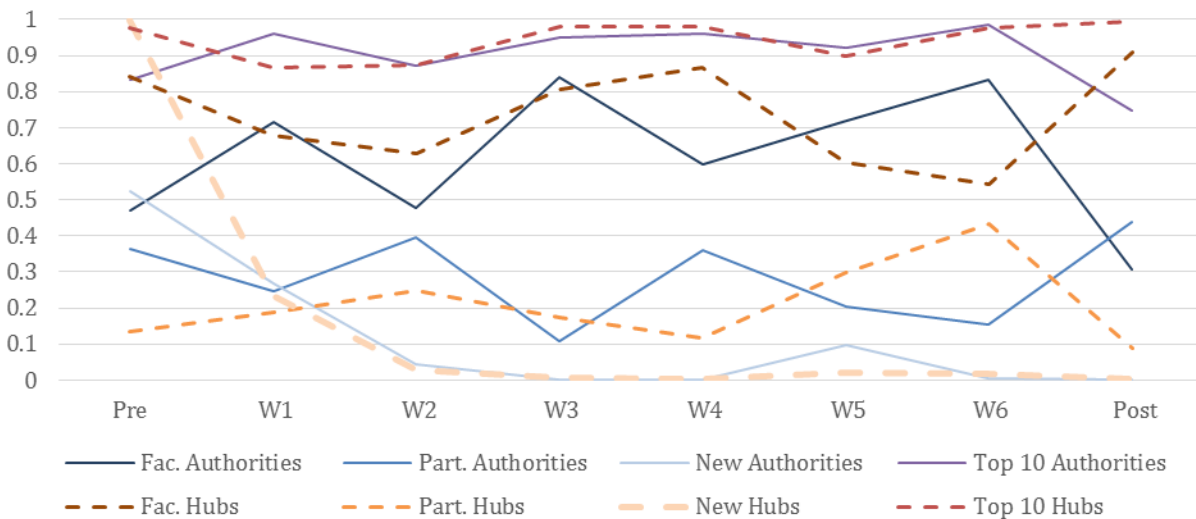


Figure 1. Hub and Authority scores of the most influential facilitators and participants each week, as well new actors to the network

The hub and authority analysis clearly demonstrates the salience of a select sub-graph of the network. While 30 unique actors constitute the top hub and authorities across the eight stages of the network, 24 of these at one time feature as both a prominent hub and authority in the network. The importance of these actors, of which the facilitators remain most influential, is reflected in the tendency of new entrants to the network to disproportionately interact with hubs and authorities. In week one 46% of all new entrants' outgoing ties are directed to these influential actors (54% dispersed across the majority of other actors). By week six this tendency increases to 68% of all new entrants' outgoing ties.

As hub scores reflect common tendencies of actors to connect with a focal group of authoritative actors within the network, an analysis of the production of actors (tweets and retweets) offers insight into how these practices relate to positioning relative to authoritative members. More simply, is frequent tweeting and retweeting directed to the most influential actors? Figure 2 visualizes the distribution of actors relative to their media production and clearly shows the most active actors are both facilitators and prominent hubs within the network. The twitter user Bali\_Maha, for example, is not only best connected to

network authorities, but far out (re)tweets other actors. The graph suggests that media production within the network relates closely to interaction patterns with the most prominent members of the network.

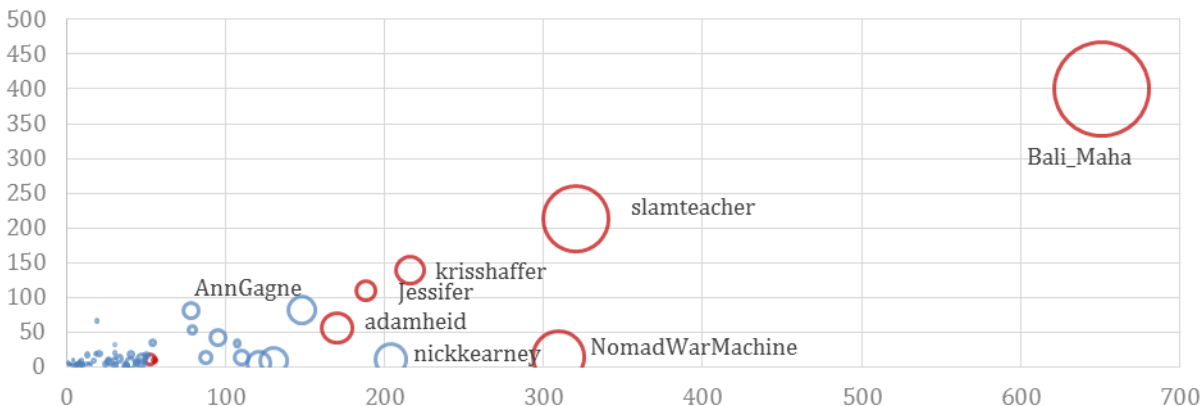


Figure 2. Network production: Actor tweets and retweets relative to hub scores (x-axis represents number of tweets, y-axis retweets; size of circle represents hub score)

In figure 3 the relative authority scores of actors are plotted in relation to the number of times an actor was mentioned by another (in-degree) or retweeted. As expected the actors most frequently interacted with exhibit the highest authority scores. Moreover, facilitators again constitute the most salient actors as they are more frequently retweeted and mentioned by other members of the network. The highest authority score, as well as most retweeted and mentioned is HybridPed, the Twitter handle of the *Hybrid Pedagogy* journal and source of course-related information. This type of actor naturally lends itself to a point of influence/authority within the network. Here again facilitators persist as the most influential members of the learning network.

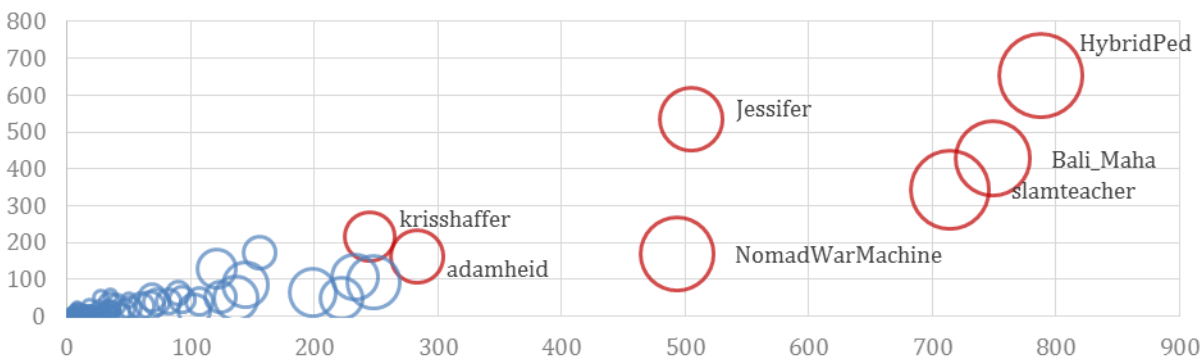


Figure 3. Interactivity and Amplification: Mentions and retweets of an actor by others relative to authority score (x-axis represents times retweeted, y-axis times mentioned; circle size as authority score)

Lastly, analysis of network expansion figures critically as the platform operation of Twitter uses follower and following networks to disseminate information. In addition to the course hashtag, the intersecting networks of following/er relationships articulate pathways through which course information and discussion circulate, as well as disseminate to weak ties who stand to participate directly in the network. Figure 4 displays the net increase in actor follower and following networks during the time of their participation in the course. While these increases cannot be definitively attributed to connections established through MMCP, the graph does provide indication that salient actors in the network sizably increased their personal networks through gained visibility and interaction with the multitude of new connections entering the learning network. Here greater diversity appears with both participants and less authoritative actors significantly increasing their networks.

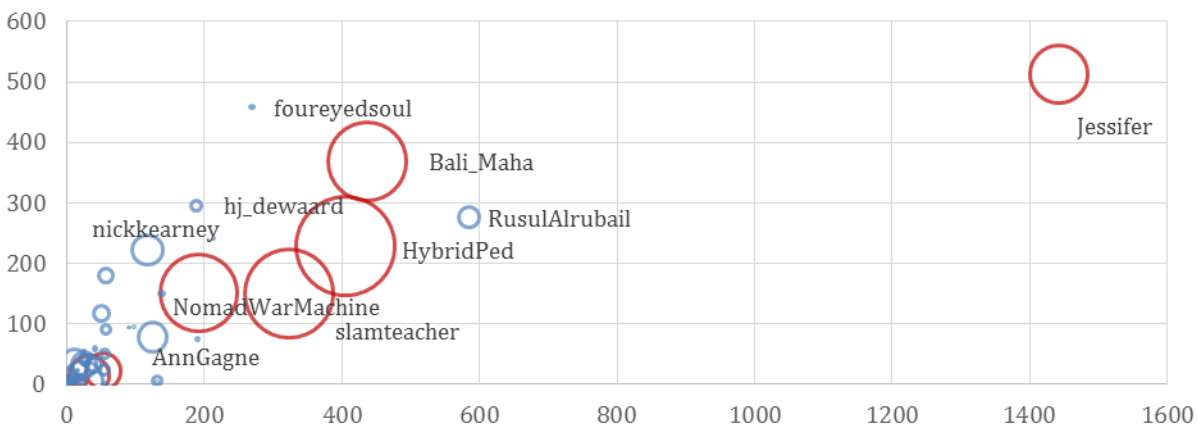


Figure 4. Network Expansion: The net increase of follower and following relationships among actors over the course of participation in MMCP (x-axis represents the net increase in followers, y-axis in those following; circle size represents authority score)

## 4 Discussion

These analyses beg further discussion in the direction of the overall problem orienting this study: how do structural asymmetries influence the development and processes of learning networks? Here only a few, brief thoughts must suffice. Analyzing the MMCP network outlines patterns of connectivity in which facilitators remain consistently focal. The presented measures also suggest a process of structured, preferential growth that finds new entrants to the network directed to the well-connected core of facilitators and participants and, as a result, contributing to the stability and asymmetric structure of the learning network. The stability and influence of the core facilitators, however, rests on the intensity of interaction among these core actors and the level of connectivity they generate as primary media producers and distributors.

The overlap between actors serving as hubs and recognized as authorities over the duration of MMCP seems to indicate a lack of differentiation between these roles. However the authoritative function of the *Hybrid Pedagogy* Twitter account (HybridPed), as the organizational locus for MMCP, remains an important exception: rarely connecting to others yet frequently retweeted and directed questions regarding course information. The facilitators and select participants comprising the core of the learning network instead contribute to a core-periphery topology and structural stability tending to restrain the dynamism of the learning network. New entrants to the network fail to immediately influence the patterning of connectivity. Rather, suggestive of Lave and Wenger's theory of Legitimate Peripheral Participation, sustained involvement seems to precede roles effecting network influence.

As hub and authority measures indicate common patterns of recognition (and thereby material-discursive patterns of production and distribution) within a network, the overlap between hub and authority actors suggests a centralization of influence as core actors reflexively recognize and amplify each other's material-discursive practices. This amplification increases given the frequency of media production and distribution (i.e. (re)tweeting), and potential personal network expansion, observed among the core of facilitators and select participants. As a result, the reflexive patterns of connectivity and frequency of material-discursive production associated with core actors stands to decisively contribute to structural limits of the learning network.

These conclusions remain primarily evocative. The patterns of structural asymmetry that develop across distributed learning networks, however, remain an empirical and theoretical occasion for developing insight into the processes shaping networked learning and the question of a networked pedagogy that consequently arises. As a sociotechnical process that brings to emergent performance the material and discursive agencies of a distributed network, networked learning can be explored within the spaces of possibility these agencies further. Moreover, if learning is to be understood as an effect of these spaces, the modes of its outlining may convey the lessons of a networked pedagogy.

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