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HOW MOOC REALITY INFORMS DISTANCE EDUCATION, ONLINE LEARNING, AND CONNECTIVISM

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INTRODUCTION

cMOOCs, CONNECTIVISM & THEIR POTENTIAL FOR NETWORKED LEARNING

Early Massive Open Online Courses (MOOCs), but especially connectivist MOOCs (cMOOCs), were met with enthusiasm for their potential to support learning in a networked world. Envisioned to implement ideas of connectivism as conceptualized by Siemens (2005) and Downes (2007a), these MOOCs recognize how technology has affected society and consequently how technology has produced changes in teaching and learning processes (Siemens, 2005). As a pedagogical theory and instructional approach, connectivism guides course designers in providing students with the newest Web 2.0 collaborative technology as the means to connect not only with each other (Anderson & Dron, 2011) but to also help them form networks through connecting specialized nodes or information sources (Siemens, 2005). In cMOOCs, these collaborative tools have been provided to support conditions where “learning is the process of creating connections and developing networks” (Conradie, 2014, p. 255). Connectivist or network learning, in essence “is the development of these networks, [...] creation of the links that make up a network. For a person, it is creating the links between the individual neurons. For a society, it is the creating of the links between people, the community of practice” (Downes, 2017).

Unique to connectivism, however, is the concept that in these connectivist spaces, learning can be a cyclical process in which participants connect to a network to find new information and also to build upon it and share the generated knowledge back to the network, so that other participants can access it (Kop & Hill, 2008; Anderson & Dron, 2011). Connectivism also offers a unique view on the “know-where” skill set (Siemens, 2005), since “where to find knowledge may be more important than answering how or what that knowledge encompasses” (Duke, Harper, & Johnston, 2013, p. 7).

cMOOCs, CONNECTIVISM, AND THEIR SHORTCOMINGS

Along with the enthusiasm about connected, networked knowledge and cMOOC spaces, connectivism and its four primary concepts (*connectivity/interactivity, autonomy, diversity* and *openness*) have been met with scrutiny and criticism. Authors such as Anderson and Dron (2011) highlighted that typical MOOC environments tend to be “plagued by lack of connection” (p. 89).

Likewise, Clarà and Barberà (2013) noticed that interactions also remain underconceptualized in connectivism, meaning that *interactivity*, the element that sustains connectivist or network learning and the fabric of connectivism that holds the networks together to connect minds and create knowledge (Siemens, 2005) was underdeveloped. Underconceptualization of interactions and their importance in moving connectivism forward was also noted by Wang, Chen, and Anderson (2014), who offered a four-level framework for interactions (from the lower levels of operational interactions to higher level of interactions, such as wayfinding, sensemaking, and innovation interactions) in connectivist spaces¹.

Without clear definitions of connections and interactions in MOOCs, MOOC providers have often resorted to familiar concepts and arrangements. This was the case of course participation, which remains one of the biggest challenges in MOOCs (Koutropoulos & Zaharias, 2015). Attempts to increase participation and completion rates were made by studying effects of groups in MOOCs (Zhang et al., 2016), by exploring student engagement with videos and forums (Bonafini, Chae, Park, Bayeck, & Jablokow, 2017), and by exploring various factors, such as gender in group formation (Bayeck, Hristova, Jablokow, & Bonafini, 2016), student time management (Nawrot & Doucet, 2014), and course length and type of assessment (Jordan, 2015).

PURPOSE OF THE STUDY, STUDY BACKGROUND, AND RESEARCH GOALS

Since connectivism is a relatively new theory (Mallon, 2013) that has not been sufficiently tested in the field (Conradie, 2014) and interactions remain important in connectivism and MOOC discussions (Bonafini et al., 2017; Kizilcec, Piech, & Schneider, 2013), and the need to study the causes for the drastic decrease of MOOC student engagement also remains (Nawrot & Doucet, 2014), this study aims to expand our knowledge about MOOC interactions by adding insights from our MOOC experiences. These insights are informed by the literature of interactions in distance education, in online learning, and in MOOCs and by the

¹ The four-level model of interactions was not tested in the field at the time of Wang et al.’s (2014) publication., and since we did not divide interactions into lower and higher level, we did not incorporate Wang et al.’s (2014) model into our discussion.

experience we have gained through our own on-going research in this area, especially the following three MOOC empirical interaction and participation studies: Bonafini et al. (2017); Jablokow, Matson, and Velegol (2014); Zhang et al. (2016).

STUDY BACKGROUND

CIC 2.0

The three studies from which we draw our main empirical insights were designed using primarily the online learning spaces of the interdisciplinary course Creativity, Innovation, and Change (CIC) 2.0 MOOC in 2014. The course encourages experimentation and experiential learning in balance with content mastery within the general content domains of creativity and innovation, and was offered through our institution preferred platform at the time Coursera. Although Coursera is considered an xMOOC interface (Koutropoulos, Abajian, deWaard, Hogue, Keskin, & Rodriguez, 2014) and has imposed its constraints and limitations to our initial course design, similarly to George Siemens and Stephen Downes' 2008 CCK08 course (Fini, 2009), we have added other tools to encourage community and node creation, thus classify CIC 2.0 both as xMOOC and a connectivist course by design since it follows the four tenets of connectivism (see course by design discussion in Mackness, Mak and Williams, 2010 and the paper discussion below). The course lessons were delivered in English (with translation available in Mandarin) over 6 weeks, with new materials and weekly assignments. Each lesson was structured around the following online components: videos (core, created by faculty and supplemental, OER or created by community members), readings (core, provide by faculty and supplemental, OER or provided by community members), exercises, reflection surveys, and discussion forums. To insure variety of opportunities for student participation, CIC offered three levels of course engagement called - Tourists, Explorers, and Adventurers. In order to receive a certificate (Standard-Normal or Certificate with Distinction), the students had to complete a level beyond the Tourist track, i.e. Explore track or Adventure track, respectively. Both levels of certification entailed formal assessment in the form of quizzes automatically graded through Coursera, but the main focus were the weekly exercises and reflection surveys. For the highest level of achievement, projects (individual or group) were required in addition to the above assessments. Social media, such as CIC Facebook account (11, 000 members), CIC Google + group (2, 400 members), CIC LinkedIn group (2,000 members), CIC Twitter (2,500 followers) were employed for course interactions beyond the Coursera platform. The course was offered free of charge to all students who did not require verified certification. For a fee of

\$50.00, CIC participants were offered verification of their work through Coursera system. Full details about the course structure and content in their original form are provided in Jablókow et al. (2014).

GROUPING PROCEDURES

We invited CIC students to work in groups within the first ten days of the course opening. The study focused on the earliest cohort of MOOC students as recorded with a lower level of dropout rates as a whole and stronger community interactions (Yang et al., 2013). We distributed a survey using Qualtrics, and groups were formed with enrolled students who volunteered to participate in the grouping study (N=770). Majority of the study participants (764) represented students intending to complete most or all course assignments.

Based on their preferences collected through the survey, participants were assigned to 18 different types of groups under several conditions. The total number of groups was 42, including experimental (study) and control groups. Participants assigned to synchronous and asynchronous study groups ($n=368$) were informed of their group members whom they were encouraged to communicate with using synchronous and asynchronous online tools, such as Skype, Google hangouts, Coursera forums, blogs, QQ, etc. The rest of the participants ($n=402$) were assigned to synchronous and asynchronous groups and to one, ad hoc control group and were advised to use Coursera forums. In addition, the ad hoc group had unlimited access to three open online Zoom rooms open for the duration of the study. Participants of both study and control groups had no specific rules or groups assignments to follow, but participants in the study groups had the contact information of the respective group members, whereas members of control MOOC groups did not have this information and could connect and communicate with anybody within and outside of CIC 2.0 community.

When the CIC 2.0 MOOC groups were introduced, we were aware that traditional groups were not ideal for connectivist learning because they constrain the four characteristics of connectivism (Downes, 2007b). Downes contrasts traditional groups to networks as being closed, undemocratic and mutually exclusive. We agree that our grouping intervention jeopardized the characteristics of autonomy and openness in the MOOC. However, we partly compensated autonomy by approaching groups as nodes that “can be connected to create an integrated whole” (Siemens, 2005, para. 1) since nodes “can be fields, ideas, communities” (para. 2). This group conceptualization carried elements of connectivism and closely aligns with our theoretical perspective, for which we were guided by the idea that one node needed the other as “survival in an

interconnected world” (Albert-László Barabási, 2002, cited in Siemens, 2005, para. 2).

For the group formation, we followed the theoretical maximum that one participant can interact with at most 150 people (Downes, 2013, as discussed in Koutropoulos & Zaharias, 2015) by providing students with options to work with peers. This way, we aimed to enhance interactivity and to reduce student interactions to a manageable number in the sea of more than 50,000 CIC 2.0 MOOC participants (Zhang et al., 2016; Bayeck et al., 2016).

WHY GROUPS WERE FORMED IN THE INITIAL STUDY

Different types of groups were created in order to study their effect on MOOC dropout rates and MOOC participation as measured by the number of forum posts and number of videos watched. We hoped that through the instructor-created groups the CIC 2.0 MOOC students would build stronger connections and trust, so the commitment to the course would grow stronger as well, which potentially will translate into higher student achievement and lower MOOC dropout rates.

This logic was built on previous research about the relationship between familiarity among members and their positive perceptions of online communication, collaboration, and teamwork satisfaction in traditional online education (Janssen, Erkens, Kirschner, & Kanselaar, 2009), as well as findings that certain level of social bond can contribute to more successful communities and higher commitment in MOOCs (Yang, Sinha, Adamson, & Rosé, 2013). We were also guided by the MOOC research that shows that students tend to prefer engagement with “traditional groups as opposed to an open network” (Mackness et al., 2010, p. 266), and students are more satisfied with the MOOC when they engage in face-to-face study groups (Chen & Chen, 2015; Li et al., 2014).

Pursuing higher MOOC achievement levels and lower MOOC dropout rates, although not the main goal for all MOOC instructors and learners, it remains important for educators like us who believe that open education should not only provide equal access to materials but also support achievement when and as needed, making MOOCs worth the investment for narrowing the educational gap.

INITIAL FINDINGS OF THE EMPIRICAL STUDIES - GROUPING AND MOOC INTERACTIONS

We report in Zhang et al. (2016) that students from four groups (19 out of 231 representatives of the ad hoc control group among them) perceived their groups as successful (i.e. 13% of the 32 groups represented in the post-grouping survey), and that overall group assignment in CIC 2.0 MOOC did not influence participants’ overall achievement rates (defined by level of course completion).

More details about the groups, participation and achievement analysis can be found in Zhang et al. (2016).

We have also reported on student interactions with peers (measured by number of forum posts) and with material (measured by the number of videos watched) as associated with student achievement levels indicating the effects of number of forum posts, and number of videos watched, along with student intention to receive a MOOC certification, on CIC 2.0 student achievement (Bonafini et al., 2017).

RESEARCH GOALS

This theoretical paper has reached its conclusions about MOOC interactions through pursuing four specific research goals:

1. To review interactions as conceptualized in more traditional distance education and online settings;
2. To compare these interactions to interactions conceptualized by connectivism;
3. To discuss the difference between projected connectivist levels of interactions and interactions seen in CIC 2.0 and other MOOCs;
4. To use connectivism and its components to discuss learners' interactions in the CIC 2.0 MOOC reality.

DEFINITION OF TERMS AND STUDY ORGANIZATION

In this study, we define *participation* as a type of *interactivity* and *engagement* at different levels (discussed in the INTERACTIONS section below). Throughout the paper, we use *participation*, *connectedness*, *interactivity*, and *interactions* interchangeably to discuss concrete interactions among groups, interactions among students, and interactions with the CIC 2.0 MOOC content and instructors. We treat *connectivity/interactivity* (also called *connectedness* in Mackness et al., 2010) as intricately associated with the other three components of connectivism (*autonomy*, *diversity*, and *openness*); thus, all four components are discussed in the paper.

We begin this study by addressing our first three research goals. First, we revisit what is known about different levels of interactions and the role of instructors and learners in previous distance and online educational settings. Following this brief overview, we juxtapose these roles and interactions to the roles the instructors and learners play in different levels of MOOC interactions, as envisioned by connectivism and in the CIC 2.0 MOOC reality. We use parts of the MOOC literature to discuss other MOOC realities as well. This comparison is summarized in Table 1.

We continue this paper by using connectivism and its four main components (*connectivity/interactivity, autonomy, diversity, and openness*) as a theoretical framework to address the final research goal and discuss CIC 2.0 MOOC interactions. We conclude with implications of the study for the future of online learning, MOOCs, and connectivism.

INTERACTIONS

INTERACTIONS AS CONCEPTUALIZED IN MORE TRADITIONAL ONLINE LEARNING SETTINGS

When considering online learning spaces, educators often think of traditional educational commonplaces of the curriculum and four levels of interactions. The commonplaces of the curriculum usually include “the learner, the teacher, the curriculum, and the milieu” (Schwab, 1973, as discussed by Barnett, McPherson, & Sandieson, 2013, pp. 691-692), whereas regarding levels of interactions, the following four levels are considered: interactions of the learner with content (or course materials), with instructors, with learners, and the interface.

The first three levels of interactions (interactions with content, with instructors, and with learners) are described in Moore (1989) and Moore and Kearsley (2005), while the last one (interaction with the interface) is proposed by Hillman, Willis and Gunawardena (1994). In a more traditional distance education context, learner interaction with content is considered the “defining characteristic of education” (Moore & Kearsley, 2005, p. 140) as a result of which one can use provided information to create new personal knowledge and change perspectives. The other level of interaction, learner interactions with instructor, is an essential and desirable communication channel through which expert feedback is provided as needed to facilitate learner interaction with course material during acquisition and application of new knowledge (Mahle, 2007; Moore, 1989; Moore & Kearsley, 2005). The third level of interaction, that of learner-to-learner, is not only important in testing one’s understanding and ideas among peers (Moore & Kearsley, 2005) but is desired and needed by many online learners (Mahle, 2007). Research shows that peer interactions have been viewed by learners as an important factor closely related to the quality of online education courses (Roblyer and Ekholm, 2000, as reviewed by Mahle, 2007, p. 48). In addition, Hillman et al., (1994) see the importance of a fourth level of interactions, the learner interaction with the interface, especially valuable interaction for technologically mediated classrooms. We focus on the four levels of interactions mentioned above but approach interface as connected to the milieu, since course context in MOOCs is “not the classroom but rather the virtual landscape” (Barnett et al., 2013, p. 696) supported by Web 2.0 technology.

In these more traditional online settings, teachers maintain active roles at all four levels of interactions. Teachers directly interact with learners and support them in their interactions with course content and milieu by providing feedback, evaluation, and guidance. Teachers also organize, manage, and support spaces where peers meet and discuss course materials (Moore & Kearsley, 2005) (the first two columns on the left, in Table 1).

INTERACTIONS AS ENVISIONED IN cMOOCs AND IN MOOC REALITY

MOOCs have been seen and promoted as disruptors of the entire process of the controlled/centralized classroom, especially disruptors of the traditional role of teachers because their role in content creation and knowledge assessment changes as advanced learners with more up-to-date knowledge can become teachers in this sense and contribute to “the connectivist learning of all” (Anderson & Dron, 2011, p. 89). Although a theoretical discussion about the advanced, more knowledgeable other, is beyond the scope of this article, here we need to point out that the reader might find similarities between the role of the advanced learners and others who the learners are learning with or collaborating with as conceptualized by Vygotsky (1978) in his zone of proximate development (ZPD) theory. According to Downes (2017), however, in connectivist learning, the more knowledgeable other, like all autonomous learners, is just another member of the network and does not hold a more privileged status but rather is a learner holding partial knowledge which is constantly updated by other "more knowledgeable" others within the network. This role shift challenges traditional interactions of learners with teacher, peer, course material, and milieu and are presented below in Table 1 (third and fourth columns on the left).

In MOOC reality, instructor and learner roles are not always consistent with the ideas of MOOCs and connectivist learning. Many MOOC students ignore the free and open structure instructors had envisioned for them to interact and network, and solely rely on the course content (Siemens, 2015). Hill (2013) classifies several patterns of MOOC (primarily xMOOC) participation behavior, which we discuss as interactions below. Another classification of MOOC student activity is provided in de Waard, Abajian, Gallagher, Hogue, Keskin, Koutropoulos, & Rodriguez (2011) and is based on authors' work in MobiMOOC in which they took part as facilitators and coordinators (de Waard) and participants and researchers (the rest of the team), and cMOOC patterns of engagement is discussed by Milligan (2012).

These patterns are as follows: No-shows, Observers (formerly called Lurkers), Drop-ins, and Active and Passive participants (Hill, 2013), Potential Lurkers, Active (contributing) Members and Memorably Active Participants (de Waard et al., 2011), and Lurkers, Passive and More Active Participants (Milligan,

2012). To simplify the table, we follow Hill (2013) classification but did not include No-shows and grouped Active and Passive learners together since they all participate in MOOCs but only with different intensity (Table 1, the six columns in the middle). We understand that there is a difference among these two groups and discuss the differences separately (see **DISCUSSION OF IMPLICATIONS** section, para. 2 and para. 3).

Majority of MOOC students are either No-shows, Observers or Lurkers who enroll in a MOOC but either do not enter the course at all, observe it, or sample a limited number of course items (Hill, 2013). Students who behave as Observers (or Lurkers) do not engage with instructors or peers and tend to treat the course as an open space, entering and leaving it as needed, mainly interacting with course content through the available media. Drop-ins, on the other hand, are students who mainly participate in parts of the course topics and are not interested in completing the course. Active and Passive learners are students who engage with course content and assignments, including peer grading and discussions inside and outside of course platforms. With minimal or non-existent direct interactions with MOOC instructors, Active and Passive learners usually participate at all three other levels of interactions shown in Table 1 (interactions with course materials, instructor, learners, and interface; fifth column from the right).

For this analysis, we focused on the four levels of CIC 2.0 MOOC engagement as provided in Table 1 (last four columns on the right) with two levels of achievement offered in Coursera platform: no certification (the Tourist track) and certification (Standard-Normal certificate or Explorer track and Certificate with Distinction or Adventurer track). These distinctions in levels of certifications were explained above and can be also find in Jablow et al. (2014). We also used the empirical findings about the two types of student interactions, with peers and with course material and their positive association with a higher achievement level (reported in details by Bonafini et al., 2017).

We noticed that these tracks and interaction levels were similar to the behaviors discussed above, and were classified as follows: (a) no certification (Tourist track) as overlapping with Observer and Drop-in participation levels, and (b) certification (Explorer and Adventurer tracks) overlapping with Active and Passive participant pattern of MOOC participation. Similar to the overall MOOC engagement patterns (Hill, 2013), the participations of learners enrolled in certification program interacted actively at all but one of the levels. They actively interacted with the content, with peers, and the interface, but had limited direct interactions with the instructors although instructors' role remained important in content creation, assessment, and management of the interface. Tourist track CIC 2.0 participants, or the learners enrolled in the no-certification course level,

similarly to learners participating as Observers or Drop-ins, were mainly involved in interactions with the course content through a variety of media.

Through the discussion above, we have addressed the first three research goals. For the first two goals, we investigated what is known about interactions from more traditional distance education and online course settings. We discussed how learner and instructor roles in the four levels of interactions as conceptualized by connectivism compared to the more traditional online educational settings and to MOOC reality. For the third research goal, we investigated differences between projected connectivist levels of interactions and interactions seen in the field of MOOC education. Our results pointed out that MOOCs have challenged two of the levels of interaction as known within the traditional formal educational settings. Table 1 depicts that in reality MOOC learners and instructors are involved in different types of interactions and their roles were not always as predicted. In part, MOOC pathways of achievement determined the roles and types of interactions, and it seems that the less open this pathway is, the more connectedness/interactions there are (see table and discussion below). In the next section, we discuss openness and the MOOC reality as we address the final research goal (*How can we use connectivism and its components to discuss learner interactions in the MOOC reality?*). For that, we look at MOOC reality as challenging and informing the four components of connectivism as originally conceptualized.

Table 1: Four levels of interactions and their relationship to instructor and learner roles in different settings: in traditional online courses; as envisioned and promoted in cMOOCs; and as seen in MOOC reality with xMOOCs, cMOOCs, and CIC 2.0 MOOC.

	Instructor role in traditional online courses (Moore, 1989; Moore & Kearsley, 2005)	Learner role in traditional online courses (Moore, 1989; Moore & Kearsley, 2005)	Instructor role as envisioned in cMOOCs (Anderson & Dron, 2011).	Learner role as envisioned in cMOOCs (Anderson & Dron, 2011).	Instructor role in xMOOC and cMOOC reality (Hill, 2013)			Learner role in xMOOC and cMOOC reality (Hills, 2013)			Instructor role in CIC 2.0 MOOC (Bonafini et al., 2017/ Jablokow et al., 2014)		Learner role in CIC 2.0 MOOC (Bonafini et al., 2017/Jablokow et al., 2014)	
					For observers	For drop-ins	For active and passive participants	Observers	Drop-ins	Active and Passive participants	For no-certification level/ Tourist	For certification level (Normal and with Distinction) / Explorer/ Adventurer	No certification / Tourist	Certification (Normal and with Distinction)/ Explorer/ Adventurer
Interaction with material / curriculum	Active role. Introduction, creation, assessment, and control	Direct interaction but content is provided and assessed by instructor	Not the main content provider and creator - co-creator of content	Active role. Can introduce, create, and assess content	Important role in content creation*	Important role in the particular content that the learner is interested in	Important role in content creation and assessment	Limited interaction with specific topics. Active role in treating course as open space	Interaction with specific topics. Active role	Active role. Often creates and assess content	Important role in content creation*	Important role in content creation and assessment	Limited interaction. Active role in treating course as open space	Active role. Often creates and assess content
Interaction with instructor		Direct interaction often initiated or required by instructor		Limited direct interactions				No interaction	No interaction	Limited direct interactions			No interaction	Limited direct interactions
Interaction with learners	Active role. Direct interaction	Direct interaction managed and supported by instructor	Limited direct interactions	Active role. Self-initiated and self-regulated	No interaction	No interaction	Important role in creating course forums	No interaction	No interaction	Active role. Self-initiated and self-regulated	No interaction	Important role in creating course forums	No interaction	Active role. Self-initiated and self-regulated
Interaction with interface/ online milieu	Active role. Management and support	Direct interaction managed and supported by instructor	Limited control over interface	Active role. Self-initiated and self-regulated process of wayfinding, networking, knowledge creation	Important role in offering and managing the interface	Important role in offering and managing the interface	Important role in offering and managing the interface	Active role in interacting with interface (media) to access materials as needed	Active role in interacting with interface (media) to access specific materials	Active role. Self-initiated and self-regulated process of wayfinding, networking, knowledge creation	Important role in offering and managing the interface	Important role in offering and managing the interface	Active role in interacting with interface (media) to access materials as needed	Active role. Self-initiated and self-regulated process of wayfinding, networking, knowledge creation

CONNECTIVISM AS A FRAMEWORK FOR DISCUSSING INTERACTIONS IN THE CIC 2.0 MOOC REALITY

In this section, we look at the interactions discussed so far in connections to the rest of the connectivism components (autonomy, diversity, and openness) and chart (Table 2) how the three components are exhibited at the three of the four interaction levels in CIC 2.0 MOOC reality (interactions with material, interactions with learners, and interactions with interface). Since interactions with instructor were either limited or not existent (see Table 1 above), this level of interactions was not included in the discussion here and in Table 2. These interactions were limited not only by time and course size but also by course design since instructor node was not the only and the most important node in this course. Also, interactions with interface were not measured and were not detailed. They were assumed to exist as a prerequisite for MOOC participation.

AUTONOMY

Students of the CIC 2.0 MOOC were *autonomous* and had control over their learning process and type of interactions “according to their own goals, purposes, objectives or values” (Downes, 2010, para. 7). In this regard, students participating at no-certification level (following the Tourist track) acted as most autonomous learners since they had exhibited freedom in choosing when and how often to interact (if ever) with materials and other learners (Table 2, first left column of Autonomy row). Students who had chosen to follow the preset assignments, assessments, and standards in order to complete the course under its two predetermined certification levels (Normal and with Distinction or Explorer and Adventurer track, respectively), similarly to the traditional online courses, might be viewed as less autonomous, and this was, we need to point out, a limitation imposed by the course design. They are especially limited in their choices of interactions with materials since in order to receive a course certificate, they were required to read and create content as part of the course requirements established by the instructors (Jablokow et al., 2014). In addition, cMOOC autonomy inherently has its own boundaries, such as levels of expertise and levels of fluency in the course language, among others (Mackness et al., 2010) since lower language proficiency and expertise levels might limit the extent to which one makes autonomous MOOC decisions.

Seeing group formation as a node-creation process that could enhance familiarity building and boost interactions with other learners, we encouraged community and network building through hashtags within and outside Coursera. Group formation also incorporated autonomy by allowing students to decide on ways to meet and communicate with peers. Thus, we marked autonomy as present in both interacting with materials and learners in control groups, but we marked

interaction with peers as absent in study groups since learner autonomy was, in a way, limited by the study design to communicating with assigned group members (Table 2, last two columns of Autonomy row, on the right).

DIVERSITY

In line with Mackness et al. (2010), the CIC MOOC 2.0 students represented a *diverse* population. They were of different ages and genders, and came from different parts of the world, with different individual needs and plans. This *diversity* created conditions to learn from each other as an outcome of these different perspectives, and, at the same time, forced the learners to leave their comfort zones.

The groups that we designed can be viewed as a constraint for autonomy since the group diversity here is managed (Mackness et al., 2010), especially in the study groups, thus diversity is presented differently for study and control groups (Table 2, last two columns of Diversity row, on the right). Same patterns of diversity presence, or lack thereof, were observed in the different CIC 2.0 enrollment pathways. For example, learners that were more committed to the course (taking the course for a Certificate) could interact with more course participants thus had access to more diverse ideas and content. On the other hand, learners with no interest to complete the course, although more autonomous, were communicating at the levels of their choice and were limiting their interactions with less diverse content and fewer learners (Table 2, the first two columns of Diversity row), where diversity in a network is defined as a creation of many entities that are each "unique in role, function and perspective" and a source of potential interactions and change within the network (Downes, 2017). Thus, when individuals decide to work alone, they do not interact with others and have no access to other entities' perspectives within this network and do not contribute to its potential change.

OPENNESS

Due to its nature, the course had no recommended prerequisites for students, making the course content *open* to everyone with internet access (Jablokow et al., 2014) and with sufficient ITC skills and knowledge of English (or Mandarin, in our case) languages since, as Fini (2009) points out, without this knowledge and skills the MOOC access is limited. Course materials were posted at the beginning of each week, and they remained open for the entire course duration (and for several weeks after the course was completed). The extended access to course materials allowed students to review their work and to continue exploring the resources provided by CIC 2.0 MOOC, leaving them with the choice to "freely

enter and leave the system” (Downes, 2010, para. 9). This characteristic supported one’s freedom in choosing to work alone or in groups, contributing or not contributing to the course.

At the beginning of the course, students were presented with the open pathways with different levels of certification, which supported connectivist *openness* by providing the freedom to choose and to move within the different interaction levels. Students following the No-certification pathway (Tourist track) in CIC 2.0 MOOC, similar to general MOOC Drop-ins and Observers, were involved in a participation behavior, which is most open and free (Table 2, first left column of Openness). They interacted at their own pace by freely visiting and leaving the course without any constraints. Their interaction with the content can be seen as informally visiting the MOOCs but possibly formally or informally interacting with learners and teachers in different courses and beyond. Also, these behaviors might be practiced when a novice participant is not ready to take a central role in the course, thus assuming a legitimate peripheral participation (Lave & Wenger, 1991)².

We can see that when MOOC students are interacting with materials, similar to traditional course design where participation means completing assignments, quizzes, projects, and working on assessment with peers, autonomy and openness of the MOOC are compromised, and the MOOC spaces very much resemble traditional online environments where these interactions are initiated and managed by the instructor. This is illustrated through the engagement of students in CIC 2.0 under the Explorer and Adventurer tracks (Table 2, second column on the left, Openness row). In contrast, the Tourist track participants illustrate the most autonomous and open behavior, but as pointed out above about the freedom to choose to work alone, one might avoid interactions with others, and thus, diversity and connectedness might be compromised (Table 2, first column on the left, Openness row).

The type of groups the learners were assigned also influenced the openness of their interactions. Being aware of the restrictions of traditional group formations, we created control groups that could function as more connectivist networks: open and democratic (Downes, 2007b). These groups with the provided three free Zoom rooms open for interactions with peers were envisioned to contain the four components of connectivism at all levels of interactions (Table 2, last right column). The study groups were to be more of a hybrid between the control, true connectivist, and traditional groups since there were closed

² These patterns of behaviors, however, are fluid and open to change in any direction of the behavior patterns (Hill, 2013). For example, one can lose interest and become a Passive participant or a No-show-up for some weeks of the course or increase participation in the course and become an active participant after having been just a Drop-in or an Observer.

formations of students who were grouped based on their expressed preferences. These groups, however, were different from the traditional closed groups since group members were more autonomous and open to decide how to interact with materials (Table 2, second to the last column).

Openness, as pointed by Mackness et al. (2010) is a more complicated concept than originally conceptualized, and thus, more than one interpretation of what open means is reflected in the MOOC participation patterns of behavior. For instance, for students who interpret openness as one's freedom in choosing how to work and when to contribute or not to contribute to the course, openness may constrain diversity, since students working alone may limit their insights and the potential of receiving feedback from others (Table 2).

By pursuing the last research goal, we unveiled a more complex picture of connectivism components than originally conceptualized. These findings can be summarized as follows: a) learner autonomy is more complex in MOOC reality; students are relatively more autonomous but not as projected since the role of teachers remains unchanged when course content and assessment are considered; b) diversity and openness are also more complex since peer interaction and open networks do not exhibit the dynamics and importance as predicted, especially in certain MOOC participation patterns and pathways; c) whereas Mackness et al. (2010) discuss paradoxes presented by the four characteristics of a cMOOC, our findings point out to a conclusion that the four connectivism components are not mutually inclusive and their interaction is not as predicted. The complexity mentioned above and its practical implications for distance education, online learning, and connectivism are discussed in the following section.

Table 2.

Exhibit of connectivism components at different interaction levels for the two CIC 2.0 MOOC pathways and the two group types

	CIC 2.0 MOOC (Bonafini et al., 2017; Jablokow et al., 2014)		CIC 2.0 MOOC (Zhang et al., 2016)	
	No certification/ Tourist	Certification (Normal and with Distinction)/Explorer/ Adventurer	Study groups	Control groups
Autonomy at the levels of interactions ^{3,4} :				
with material	✓	-	✓	✓
with learners	✓	✓	-	✓
Diversity at the levels of interactions:				
with material	-	✓	-	✓
with learners	-	✓	-	✓
Openness at the levels of interactions:				
with material	✓	-	✓	✓
with learners	✓	✓	-	✓

³ interactions with instructors were either limited or not existent and were not included in the table;

⁴ interactions with interface were not measured and were not included in the table. They were assumed to exist as a prerequisite for MOOC participation. CIC 2.0 instructors introduced different types of tools and social media (e.g., Facebook, CIC 2.0 Google hangouts, CIC 2.0 LinkedIn group, CIC 2.0 Twitter account, 3 Zoom rooms) that were outside Coursera platform.

DISCUSSION OF IMPLICATIONS

MOOC interactions discussed so far will be informative and useful in the following three practical ways. First, it is important to deal with the fact that MOOC reality diverged from the predicted power of MOOCs to drastically change students' role. This reality informs us about what this role is and how much of this role learners need or want at what stage of their learning.

The idea of open network clashed with the MOOC structures since many of the MOOC structures (even in the first MOOC on connectivism in 2008, and in many MOOCs in 2014) primarily follow the old tradition of the teacher-centered design and assessment (Mackness et al., 2010; Siemens, 2015). Even the name "course" signals a close affiliation with the formal schooling (Mackness et al., 2010), so when students generally sign up for credit and expect to be assessed, they do not always plan to play an active role in content contribution, but might rather expect the rest of the structure (support, assignments, moderation, authority, etc.) to be in place as well. When groups were offered in CIC 2.0 MOOC, students in general did not expect to play an active leadership role, and the word "course" also seems to have triggered expectations of more formal group guidance, since some students commented on the lack of it (Zhang et al., 2016). When discussing patterns of cMOOC engagement, Milligan (2012) classifies this behavior as passive since these participants "expected 'to be taught'" (para. 5).

Learner roles as exhibited in MOOC reality matched the CIC 2.0 MOOC learning space: a hybrid between formal structures of distance education and online learning, and the open, voluntary participation, the informal, lifelong-learning type of commitment (Siemens, 2015) of many enrolled students. Learner participation and interaction patterns can also be divided into formal and informal participation. The formal patterns, learners enrolled in Explorer and Adventurer tracks, seem to be followed by learners with specific goals. However, students who are used to more formal and traditional courses (Anderson & Dron, 2011) with more explicit support may drop out in spite of their motivation to complete the course. Although informal participation of Observers can be classified as the true open and free participation of a life-long learner who is least likely to be motivated to earn a course certificate, this behavior would not classify as a standard cMOOC engagement since there will be no or limited network linking (Milligan, 2012).

From the imposed limited course options we offered, two patterns of interaction behavior emerged. Based on these observed patterns, we suggest that course designers anticipate potential occurrence of these two types of MOOC behavior in the future: following Certification track (Active and Passive participants) and following No-certification track (Observers/Tourist track). In

order to meet expectations of life-long learners (Observer/Tourist track learners) whose role will be to interact primarily with the content with no expectations to interact with instructors, quality content and easy and open access to content will be essential.

For learners with more formal expectations and motivation to receive a course certificate, limited support can be incorporated around content, fostering student interactions with it and with peers. Siemens (2015) suggests scaffolding to help students unlearn old concepts of student roles in content contribution and help them make the framework shift. In order for the formal MOOC educational spaces to work well, however, different types of activities need to be built in the course design. Some of these activities support learning, and others support building self-directed learning (SDL) and self-regulated learning competencies. Activities supporting learning in the course such as aggregation, relation, creation, and sharing (as presented in Conradie's 2014 discussion of Kop's, 2011, pp. 254-255) relate to how learners access and evaluate old knowledge, remix it with personal knowledge to create and share new knowledge.

It is important to note that introducing scaffolding support and activities, however, will limit student autonomy and their role, while it will expand the role of teachers and will cause MOOC spaces to resemble more traditional online courses.

Second, diversity and openness of interactions and networks in MOOC reality also diverged from the original connectivist concepts and will be informative for designing future MOOCs. The open networks as we had envisioned them in control groups might not work for all learners. These groups were to support learner interactions and account for their autonomy, diversity, and openness (Table 2) but did not result in higher success rate or higher student perceptions of their values compared to the study groups (Zhang et al., 2016).

Since engagement in MOOCs remains important even for SDL (Mahle, 2007), compromising openness and introducing more traditional online techniques for interacting with materials and others might be appropriate for students enrolled in Explorer and Adventurer MOOC pathways. For example, for these learners steps can be taken for addressing online isolation and loneliness through social engagement and interactions (Slagter van Tryon & Bishop, 2009) by understanding and supporting stages that "facilitate knowledge sharing as students work collaboratively to solve problems" (p. 300). Increased level of interactions, follow ups, and comprehensive technical support can be used as compensating strategies (Slagter van Tryon & Bishop, 2009, pp. 303-304). Although openness will be compromised, these students will be closer to achieving their certification goals.

This type of connectedness does not seem to be important to connectivist MOOCs since “learning process must create interconnections for knowledge that is distributed over many actual and virtual locations. Maintaining these connections then becomes a learning skill that is essential for life-long learning in a technological information society” (Verhagen, 2006, para. 3). The theory becomes not about connections but about “pattern recognition” as described in Mackness et al. (2010, p. 270) and Downes (2017) and along with the open networking opportunity as similar to the control groups created for the CIC 2.0 MOOC group study, it might be more relevant for the learners enrolled as No-certification seekers. On the other hand, if we aim to create and support network links and community of practice (Downes, 2017), dimensions of communities of practice (CoP) discussed by Lave and Wenger (1991) might prove important as well. These dimensions are summarized by Smith (2009) as the purpose around which CoP self-organize and the relationships participants develop and are involved in while participating in variety of CoP.

Finally, the four connectivism components (Table 2) were also exhibited differently in MOOC interactions and in the group formation reality. All components were not present at all participation levels and were actually mutually exclusive. For example, the more autonomous the learners were in making decisions to freely enter and exit the course and interact (if ever) with materials and peers on their own terms, the less access they had to diverse ideas, i.e. autonomy and openness seem to not coexist, but this arrangement looked satisfactory to learners enrolled in No-certificate (Tourist) track. The opposite was true for learners representing the Certification track. The less autonomous and open they were in their choices to interact in CIC MOOC (especially with the course material since this was needed for certification purposes), the more chance they had to interact with diverse ideas. When designing for these two main pathways and MOOC participation patterns, it will be valuable to remember this interaction to order to meet learners’ needs.

CONCLUSION

This study did not aim to prove or disprove connectivism as a learning theory but aimed to contribute to the connectivism debate. We juxtaposed MOOC interactions from several studies onto the traditional levels of interactions as conceptualized in distance education and online learning and discussed MOOC reality as informing not only the known concepts of participation, interactions, and group work but also informing connectivism and its four main components. Connectivism theory employs elements of theories and concepts such as cognitivism, constructivism (Mallon, 2013), informal learning and Vygotsky’s activity theory (Conradie, 2014). One can also argue that there are elements of

other theories in connectivism, such as diffusion of innovation and social networking (as discussed by Backstrom, Huttenlocher, Kleinberg, & Lan, 2006), social capital (as conceptualized by Bourdieu, 1997), and life-long learning (after Livingstone, 2011).

In order to create a more supportive environment in which MOOCs can continue to thrive offering new opportunities for learning and interacting in this connected world, it is essential to understand student levels of interactivity and MOOC participation patterns from this more historical perspective, as well as rely on activities that have been proven to work when applying previous educational and learning theories.

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