Chapter

A Typology of Peer Support Behaviours in a MOOC

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Abstract

This chapter builds upon a body of previous research that has used content analysis to assess the messages exchanged between participants enrolled on a Massive Open Online Course (MOOC). In particular, it focuses on uncovering the nature of the peer support that the participants provide for each other, and the social environment that they establish through their interactions. The findings of this research have led to the construction of a Typology of Peer Support Behaviours which is presented here. It is proposed that this typology can be applied across a range of contexts to assess the nature of peer support behaviours enacted by participants in those MOOCs. It is proposed that the typology could help identify any unique differences in expression of behaviours among groups of students and it could be used to assess if there is a preference towards a particular approach to, or type of, peer support.

Keywords: MOOC, peer support, typology, teaching presence, social presence

1. Introduction

MOOCs are another incarnation of the online learning paradigm. They differ from the traditional formal online learning approach which is generally closed off and only accessible to a few registered participants, and often requiring some prerequisites to be met prior to participation. Although a small proportion of MOOCs charge an enrolment fee [1], MOOCs are predominantly open and usually free to participate in; as a result they tend to attract a large number of participants. The MOOC format was conceived in 2008 by George Siemens and Stephen Downes when they developed and deployed their inaugural course Connectivism and Connective Knowledge (CCK08) which attracted over 2000 participants [2, 3]. MOOCs have gained a stronghold and drawn much attention to learning analytics research and the open education resource movement. In their current and popular manifestation, conceived by Stanford professors Sebastian Thrun and Peter Norvig, MOOCs do not deviate far from the traditional online learning model, but through technological innovation have opened up access to educational content with a low barrier of entry [3, 4]. George Siemens categorises MOOCs into three distinct groups based on their approach in facilitating learning for their participants: *Connectivist*, *Instructivist* and *Open Learning Resources* [3].

- Connectivist MOOC (cMOOC): the initial conceptualisation of MOOCs as developed and deployed by George Siemens and Stephen Downes allows participants to network and collaborate among themselves to identify their

individual learning needs, then create and follow their own learning path. Learning in this MOOC format is self-directed, the instructor does not define learning paths or outcomes but is available and involved in the process to facilitate the participants' learning. Using the interaction equivalency theorem, Miyazoe & Anderson benchmark cMOOCs as having low student-teacher interactions, medium student-content interaction but high student–student interactions highlighting the nature of the cMOOC variant as student–student interaction driven [5].

- Instructivist MOOC (xMOOC): these follow the traditional online learning model closely. Learning paths and goals are predefined by the facilitator featuring reading materials and instructional videos often interspersed with quizzes and end-of-module assessment. The course is often scheduled to run for a set duration, usually over the course of three to twelve weeks. Some courses though are self-paced without a hard deadline or end date, allowing participants to follow along on their own schedule. Miyazoe & Anderson benchmark xMOOCs high for student-content interaction, low for student-teacher interaction and low-to-medium for student–student interaction [5]. They highlight that for xMOOCs participants are drawn to the content which is usually video recording of lectures by academics renowned in their fields.

- The third MOOC variety, according to Siemens, is open learning resources made openly available such as MIT's Open Courseware [5]. These are generally dumps of video recorded lectures and assessments in the form of documents that can be downloaded to use. These resources are made freely available to anyone to use. Usually there is not a structured community of participants as found in the other two variations of MOOCs, and assessments are not graded as is found in xMOOCs. They may also not be updated as frequently as xMOOCs will be. Reference to MOOCs from this point onwards (unless otherwise stated) will be in Ref. to xMOOCs only.

MOOCs attract a myriad of participants from various age groups and with varying levels of experience, interests and motivations [6, 7]. Though some prerequisites may be set, they are not used to bar any participant from entry if they are not met. As such it is not surprising that the major issue faced by providers of MOOCs is a high attrition rate, aptly conceptualised as "the funnel of participation" [8] where a MOOC course attracts several thousands of participants, but only a few follow through to completion, with conservative estimates pegging this figure at about 10%. Time constraints feature as a major driver of attrition especially when participants were faced with other priorities in their daily lives [9].

2. Interactions in MOOCs

In an online learning environment, participants need an avenue to interact with fellow learners, to share ideas and seek assistance with challenges in the course. Discussion forums have been the dominant platform where these interactions take place [10]. They are usually built into the online learning platform, are usually text-based and asynchronous in nature. This allows participants the flexibility to freely share and attend to each other's inquiry at a time that is convenient.

Unlike in traditional online learning platforms with comparatively fewer students, the large number of participants taking part in a MOOC can generate voluminous amounts of communication which can lead to data overload for the

participants [11, 12]. There has been increasing interest in research focusing on this phenomenon and how it may impact the learning process and learning outcomes of participants in a MOOC.

MOOC students interact with the discussion forum in various degrees and levels. The interaction pattern that occurs in the discussion forums can be used to categorise participants as: *active participants*, *lurkers* and *passive participants* [13, 14]. Studies have highlighted that the majority (about eighty per cent) of participants are lurkers who do not participate in "visible" forum activities such as publishing posts or commenting [13, 15, 16]. They usually do not follow the course actively but engage with the content at a slower pace, and search through or peruse content on the forum created by the other participants. Lurking may result from personal commitments that may hamper frequent participation in the course. However, some lurkers do so by choosing to consume and reflect rather than actively participate and benefit from ongoing discussions that ensue in the forum [13, 17]. Compared to lurkers, who will only follow a discussion and do not usually initiate one, passive participants follow and contribute to ongoing discussions or start their own, albeit their participation is less frequent and irregular. Active participants, so-called "superposters" [18] or "wholly engaged" learners [16] exhibit above-average engagement patterns by starting, facilitating or contributing quality content to discussions. Though they comprise a small subset of the population, they contribute the majority of relevant discussions on the forum and provide helpful assistance to their fellow participants.

The interactions of the participants are also relevant for their socialisation process, which can facilitate the establishment of a community and thus create a conducive social climate that fosters free and open expression of thoughts and ideas. However studies that examine participant interactions indicate overall participation in forum discussion decreased over time, and noted participants came together and dispersed in a crowd-like pattern rather than as a cohesive community, and that a majority of the discussions were carried out by students who were high-performing [19]. This peer-led discussions in the forum have been observed to promote discussions and engagement as well as active learning [20].

Only a few of the total registered participants interacted in the discussion forum, leading the researchers to wonder how or why more participants were not drawn to interact in the forum and possible remediation strategies. Some have noted that by virtue of the minimal information participants have about each other, save for what is shared in the forum, "experts" who could be approached to act as mentors to foster deeper learning and collaboration are not identified [21].

3. The Community of Inquiry framework

In late 1999 Randy Garrison, Terry Anderson and Walter Archer, three researchers focused on distance education, were confronted with a challenging issue: to make sense of interactions in a new online graduate program offered by their faculty. This had the effect of aligning their research to issues around the use of online text-based platforms to facilitate teaching, interaction and learning. Thus came to be the research team whose seminal work was the Community of Inquiry framework [22]. According to Garrison [23], the framework is predominantly based on the collaborative and constructivist ideas of John Dewey [24] in that meaning or knowledge is constructed and shared through interactions. The framework has been developed over the years and is much favoured by online learning researchers for its holistic approach to online learning research [22, 25]. It comprises three overlapping

components that Garrison et al. postulate as needful in an online learning environment, with the intersection of the components posited as producing a meaningful learning experience. These three components - Teaching presence, Social presence and Cognitive presence - encapsulate the modalities of interactions in an online learning environment.

Social Presence captures the development of social interactions to create a productive social environment. In a mediated environment where participants are unable to infer nonverbal cues of other participants in an interaction, participants convey their sense of self through the thoughts and ideas they share. By projecting their personal identities through their interactions, participants are able to identify with each other and the community thus establishing a trusting environment that allows participants to interact freely. This can allow inter-personal relationships to develop which fosters group cohesion. The development of group cohesion is ideal if participants are to interact productively and meaningfully to facilitate their learning [26].

Teaching presence captures the facilitation and organisation of the course and actions of the instructor for the advancement of the learning process. Teaching presence serves a mediating role of balancing (and fostering) the social presence of participants (needed for free and open discourse) and guiding their cognitive presence towards achieving their learning goals. Teaching presence is predominantly enacted by the instructor and occurs not only in the online learning environment but offline as well, such as during the instruction design and preparation of the course syllabus and specification of learning outcomes [25]. The teaching presence role however is not limited to the instructor but can be carried out by participants through their interactions hence the reference to this component as "teaching" rather than "teacher" presence [27, 28]. Through their interactions, learners may assist each other to navigate the course content, providing helpful guidance and direction [27]. This may be institutionalised through the appointment of student moderators or teaching assistants from the cohort. This peer support is needful in an online learning environment where instructors may not be able to attend to each student individually and where learners can take the course in their own time. This

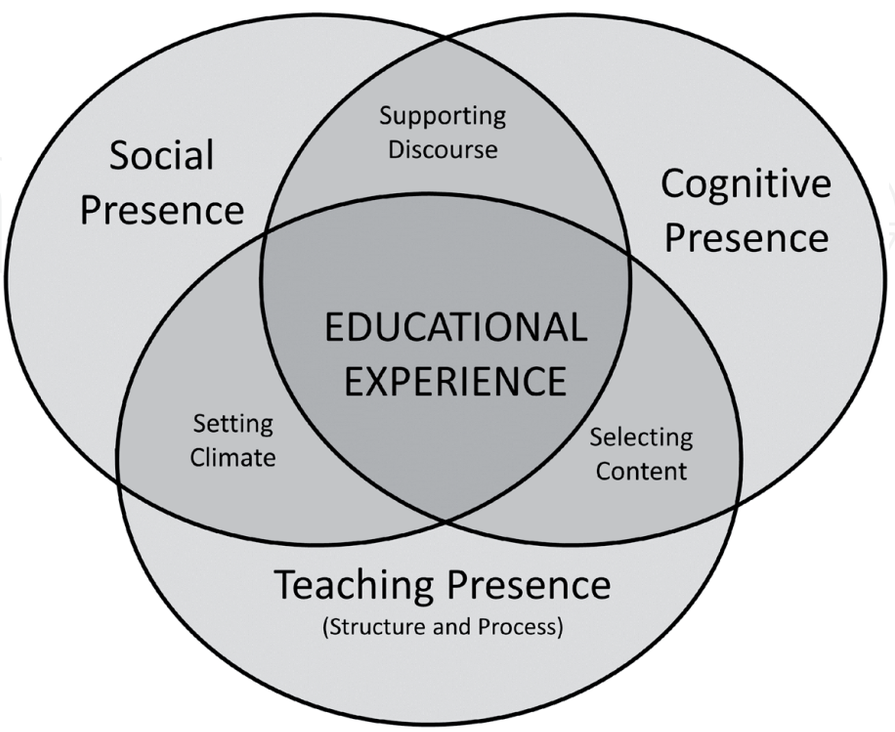

Figure 1.
Elements of the Community of Inquiry framework [29].

essentially necessitates an open environment where participants have the freedom to speak freely and express their opinions, to be able to provide assistance to other participants when required.

Cognitive presence captures the meaning-making process which the participants engage in to facilitate their learning. Cognitive presence highlights the development of critical thinking when students are able to engage successfully in inquiry-based learning [29]. Though the three presences all influence one another in various ways and degrees, cognitive presence has been observed to be heavily influenced by social presence and teaching presence.

The Community of Inquiry framework has evolved and has been adapted over the years from its beginnings as a tool to evaluate the effectiveness of online learning environments to a framework shedding light on learning patterns in online learning environments [30, 31] and recommending strategies to enhance the effectiveness of participants engaged in the learning process [32, 33]. The framework is described as a process model because it "embraces a constructivist orientation in which the emphasis is on how we construct knowledge" [34] and reflects the dynamism of the learning process that is to be encountered in an online learning environment as reflected by the interplay between the three components of the Community of Inquiry framework. A conducive learning environment that fosters free and open communication with other participants is the main function of the social presence element. Discourse is then able to ensue, allowing the participants to express cognitive presence. Via interaction with the course content and communication with fellow participants, teaching presence facilitates the other two elements in the framework to support the learning experience (**Figure 1**).

4. Findings from previous research

Below we present the findings of a study carried out to gain an insight into interaction behaviours of MOOC participants towards enacting peer support and social presence. With limited course staff consisting of one facilitator and four teaching assistants, all of whom were based in the United States of America, providing adequate support for a large proportion of participants would be a difficult undertaking for the team hence participants relied on other learners in their cohort for support. Interaction logs of discussion forum usage were processed using statistical models to categorise participants interaction pattern. The Community of Inquiry framework was then utilised in a content analysis to assess the messages exchanged by participants in the discussion forum. Themes extracted are from this process are presented below.

4.1 Social presence served as a utility to facilitate learning rather than to foster interpersonal bonds for community development

Open Communication was identified as the most frequent of social presence indicators exhibited, comprising 70% of the interactions coded in the dataset. This was followed by the *Group Cohesion* indicators (15%) that reflect self-identification with the group, which is an essential requirement for collaborative learning in MOOCs. In the Community of Inquiry framework, group cohesion is demonstrated by the use of vocatives, referring to the group using inclusive pronouns, phatic, salutations and greetings, course reflections and social sharing. Social sharing interactions where participants share portions of their personal lives (such as birthdays, vacations etc.) unrelated to the course content were absent in the dataset studied. This absence may be the result of a possible weak interpersonal bond among the

participants; nonetheless, the high presence of open communication does indicate participants freely expressed themselves.

Affective indicators were exhibited by the participants in this study. Indicators under the Affective category capture the use of unconventional expressions to reflect emotion and humour. Affective indicators also highlight the disclosure of personal information, such as personal experiences related to the course content and challenges they may be facing. In a text-based discussion forum that is devoid of visual and auditory cues such as body language and tone in voice, affective indicators serve to transmit a participant's moods, feelings and emotions. Indicators found within this component allow the learners to express their opinions, emotions and perceptions freely, thus promoting open communication and collaboration among them. Phatic expressions, greetings and salutations comprised over fifty per cent of group cohesion indicators identified. Coupled with low densities of course reflection and referencing the group using inclusive pronouns, it may indicate weak (or the absence of) interpersonal bonds as such interactions predominantly become polite or formal social exchanges, a situation highlighted in [35].

4.2 Distributed teaching: facilitating learning with clarifications and relevant external resources

The teaching presence was enacted primarily through the facilitation and organisation of the course content and serves to promote knowledge sharing among the participants. Teaching presence is not limited to facilitators alone but "all participants assume teaching and learning roles and responsibilities to varying degrees" [23]. Indeed, with industry experts and some participants taking the course as a refresher, there were opportunities for knowledge sharing in the forum. *Direct Instruction* appeared to be the most expressed teaching presence indicator comprising 65% of all messages coded for teaching presence. This involves knowledge sharing on the subject matter by the participants. This involved interactions such as making explicit reference to outside material that the sharer found to be useful and relevant. This indicator was followed by giving information that clarifies issues with the course materials and offering useful illustrations that facilitate in the clarification exercise.

Facilitating Discourse expressions can be employed to steer interactions towards learning objectives by the instructor. In this study it was enacted by participants primarily as a way of encouraging, acknowledging and reinforcing contributions from other participants, and drawing in participants, promoting discussions. Participants expressing this indicator may only be focused on the current context of the message being replied to and may not have an overarching learning goal that a facilitator or instructor will hope to achieve.

Assessment indicators were lacking in this study. This was anticipated as students did not have provision to assess or evaluate other learners' test submissions or results. This is a critical concern in MOOC learning, where peer-grading could play a significant role in re-enforcing learning. Some MOOC platforms (such as Coursera) utilise peer assessment to this end, though their primary design was to surmount the technical challenge of grading value-based subjective coursework [19, 36].

4.3 Peer support: openness and willingness to explain and provide examples

The demographic profile of participants in the study were predominantly young and well educated, some to Master's and PhD level. The presence of these participants, especially those with an economics background, could have been an avenue for support to other participants.

One of the primary limitations of the dataset, and hence this study, was the lack of an identifying link between demographic information and messages in the forum. This could have been used to assess the contributions of participants by their academic level. This can highlight, for example, whether participants with higher degrees (or experience in the area) carry out more peer support. In this study, only a few participants actively contributed in the discussion forum. A majority of participants' interactions in the forum was focused on searching and reading with very few posting or replying to messages of other participants. With such a large number of participants, it may be that participants are able to find a query to have already been asked and answered hence lowering the need to post a message. This behaviour requires further investigation to assess the correlation (if any) between the number of participants in a course and volume of messages in the forum. This pattern of use may highlight the discussion forum as a utility to obtain support rather than to collaborate for community building.

Some of the participants, with or without intention, demonstrated teaching presence to the notice of other participants. This was captured in the below message of a student requesting assistance from another student via another student's thread:

> *Hey [student's username], can you answer a question I posted in this thread: [web link to question in the forum].*
>
> *Thanks.*

Anderson et al., part of the initial collaborators on the Community of Inquiry framework, highlighted this duality of students to act as teachers when developing the framework [27]. However, this dynamic role that a participant may play was not given much focus, granted at the inception of the framework online classes were not as large as MOOCs have become.

The teaching presence category consists of the following elements: *Instructional Design and Organisation*, *Facilitating Discourse*, *Direct Instruction*, and *Assessment*. The course facilitators are chiefly responsible for designing the course and organising the curriculum, resources and assessments hence it was anticipated (and was observed) that the teaching presence indicators that will be exhibited by participants would be concentrated within the Facilitating Discourse and Direct Instruction categories. A closer look revealed these expressions were concentrated within a few indicators.

More than 65% of messages coded for teaching presence were in the direct instruction category. This category comprises indicators such as providing valuable analogies, offering useful illustrations, supplying clarifying information and making explicit reference to outside material. These indicators classify messages that are intended to make the course material comprehensible or accessible to other participants. MOOC participants come from diverse backgrounds and experiences. In this study, a number of experienced professionals from various industries were observed to disclose their background and experience in an effort to clarify a point or share an experience in line with the course material; an example extract is produced below. This was in response to another student's submission to a discussion prompt:

> *At 5:30 during the lecture 'Are the competitive markets efficient?', Professor Taylor refers to MRIs as 'magnetic research imaging scanners', but MRI actually stands for magnetic resonance imaging. I know this is rather pedantic, but my many years in radiology requires that I call your attention to this point. It is certainly true that there are far more MRI scanners in the US compared with either the UK*

> *or Canada, but this is primarily a function of our for-profit healthcare delivery system as well as insatiable patient demand in this country for the latest medical technologic advancement regardless of the cost (usually borne by a third party or received as an untaxed benefit from their employer).*

Participants sharing their experiences can help make the course content accessible to other participants by reformulating the course material or by providing relevant and relatable examples from their personal lives and work experience. Participants utilised social elements frequently in their enactment of peer support, highlighting social presence as a core component of teaching presence with a wider overlap in its role in facilitating discourse within the discussion forum [37].

Another interesting observation was the sharing of external resources mainly in the form of web links to articles, documents and videos which show a willingness of some participants to assist other students in the course with relevant material they had found useful. This was the most frequent activity carried out by participants in their peer-support efforts. Though the facilitator may be expected to provide extra resource materials, this may not satisfy the needs of all participants. Participants may most likely share external resources that may be localised to the specific need of the student requesting assistance. The following two extracts from the forum demonstrate participants sharing helpful resources to other participants:

> *True. I think we will learn more about this later but here is the Gini coefficient for the US against time [link to an image of a graph]. The Gini coefficient is a measure of inequality. You can see how the U.S. has changed towards more income inequality in the past 40–50 years.! Income Gini Ratio, U.S., Investormill.com: https://investormill.com/data/income-gini-ratio-households-by-race-of-householder/*

> *I did some further online searching and found a good article at http://www.popcouncil.org/uploads/pdfs/frontiers/Capacity Bldg/WTP Manual.pdf on how Willingness to pay is actually collected. It does not deal with the case here of increasing numbers of bananas - but it [does] convince me that the data here is misleadingly displayed and that the Marginal Benefit = Willingness to Pay for additional item is the question that was actually asked and the data that was used to build the misleadingly labelled 'Willingness to Pay column'. If this is not the case then the argument given here for deriving the Demand curve is simply wrong.*

As has been observed so far, participants provided rich comments and responses to their peer's submissions, some of which can be seen in the use of illustrations and analogies to reformulate and explain concepts to fellow participants. With a large number of participants with varied experiences, there is the likelihood of a participant having the background and experience that can better explain a point, concept or idea from the course material. This characteristic is also manifested through demonstrations by example, the clarification of information, and the use of illustrations and analogies to simplify course material to assist other participants in the course. The dataset that was used in this research did not tag each participant to the messages they shared; this limits the ability of this study to identify and characterise at an individual level participant's peer-support behaviour however the overall impact can be observed. The following message extract shows a participant stepping in to help another student whose query had received no response for an extended period of time. The responder may have chanced upon the participant's query while searching for answers to their own query, and it may also be

the responder may have sought out forum posts that had received no responses, by using the filter and sort functionality available. Note that the course spanned an eight-week period, hence this intervention may have arrived at the tail end or after the course:

> *I'm surprised that no one has responded to your request after 2 months. Marginal cost is what it costs to produce one more unit of a good or service. So if, say, one unit of a good costs a firm $3 to produce and two units together costs $7 to produce, then the marginal cost of producing the second good is the $7 cost for producing two units minus $3 for producing just one unit or $7 - $3 = $4 for producing the second unit of the good.*

The majority of the teaching presence indicators were enacted in the direct instruction category. We observe that some participants actively reformulated the course content for those who needed assistance and frequently provided additional resources to supplement their feedback. The student's expectation of the teacher is to provide "content knowledge that is enhanced by the teacher's personal interest, excitement and in-depth understanding of the content" [27], qualities that may be exhibited by knowledgeable peers that participate in a MOOC out of interest or as a refresher as discussed in the literature review.

Anderson et al. defined facilitating discourse as the component "that stimulates social process with a direct goal of stimulating individual and group learning" and is a shared activity between teacher and students [27]. This definition aptly describes the overlap of the social presence and the teaching presence, which is described as providing intellectual and scholarly leadership towards the growth of knowledge of the students. The Community of Inquiry framework posits that the teacher ought to be not only a content deliverer but also an active member of the community engaging with the participants by commenting with supportive responses to facilitate their learning, a role that experienced and knowledgeable participants can be encouraged to fulfil.

Of the eight indicators that form the facilitating discourse component, only four were exhibited by the participants in the forum. The absence of these indicators was not surprising. These indicators*: Present follow up topics for discussion*, *Refocusing discussion on specific issues*, *Seeking to reach consensus* and *Setting climate for learning*, may require deliberate effort by a facilitator, enacted to steer participants towards attaining a learning outcome. A student providing peer support may not deliberately embark on enacting these indicators. Furthermore, the student providing peer support may lack requisite toolset and professional skills to carry out these indicators. Out of the four indicators that were expressed in facilitating discourse category, *Drawing in participants* and *Encouraging, acknowledging or reinforcing student contributions* were the most frequently expressed indicators. The discussion prompts which were employed as part of the pedagogy of the course provided an opportunity for students to share their thoughts, and while perusing the contributions of others could chime in an acknowledgement or contribution their own submission. The following is an extract from a contribution by a student who was adding to the responses by two others that had responded to a contribution submitted by another student:

> *Thanks [Student 1] and [Student 2] for your insightful comments. If I recall correctly, Specialisation, Division of Labor and Comparative Advantage apply for 'better trade'. Does it apply also to the 'economy?' In the example that [Student 1] articulates here yes, the economy gains when income is freed up for other expenditures, ...*

The results of the study highlight that very few participants were actively engaged in the discussion forum, a scenario that has been observed in previous studies [15, 16]. However, these few active participants account for only a few of the responses that participants received. The majority of messages and responses are submitted by the larger pool of participants that would have made a submission about once or twice for the duration of the course. Social presence expressed was superficial and primarily served to facilitate interaction and not utilised for community building. Further studies are required to develop a more complete picture of social presence enactment in MOOCs, especially studies that investigate the social presence of active and passive participants separately. Teaching presence also was distributed in that it was expressed by several participants with most participants enacting it once or twice. Though this is beneficial for the facilitators (by reducing load) and for the participants (by benefiting from other experienced participants) further research is required to investigate in more depth how this can be fully actualised and its impact in a MOOC.

5. A typology of peer support behaviours in a MOOC

This section presents a typology that builds upon the findings highlighted earlier. Once developed, the typology then can be reused in other MOOC contexts and settings to assess the enactment and nature of peer support activities. The typology is influenced by the Community of Inquiry framework. Though the Community of Inquiry highlights that participants can carry out teaching presence the Community of Inquiry framework is focused on teaching presence carried out by the teacher or instructor. An opportunity, therefore, exists to address this gap in the framework to provide a means of assessing student–student interactions that are geared towards facilitating the learning of other participants. A typology capturing the behaviours of participants engaged in this type of activity is a step towards addressing this gap.

MOOCs exemplify the reduced capability of teachers and instructors to provide adequate support to learners via direct interaction with each student and the increasing role of learners to support each other through the learning process. This typology aims to focus on the peer support carried out by participants as opposed to the entire learning process which is the focus of the Community of Inquiry framework. The typology hence acts as an add-on or extension to the Community of Inquiry framework to capture peer support interactions. A reusable tool provides consistency in use across different environments and contexts useful for benchmarking and comparisons when utilised across different contexts.

Research into the nature of peer support in MOOCs is ongoing and evolving; as such there are a number of reasons that a typology will be useful for the ongoing research in peer support behaviours that are enacted by MOOC participants. First, a typology provides a simple way to organise and make sense of peer support behaviours to provide a coherent description of the behaviours enacted by participants. A typology can also facilitate communication between both researchers and practitioners who are exploring pedagogical strategies. A typology can also help identify interplays between the observed behaviours and by extension predict possible behaviours that could occur. The typology provides a framework for accessing peer support behaviours carried out by participants in a MOOC discussion forum. The typology has applications for future researchers in building upon the body of knowledge of participants interaction behaviours in a MOOC context. The typology is presented as a descriptive framework with no stipulated hierarchy nor does inclusion of a characteristic suggests importance. The typology is envisioned as a tool to compare peer support behaviours carried out by participants in different MOOC

contexts that can inform pedagogical strategies employed to facilitate achieving learning outcomes and objectives especially from the participants perspective.

5.1 Extracting peer support behaviours

The constituents of the typology are derived from the coding of discussion forum interactions carried out by participants in the MOOC used in the study. This coding was carried out using the Community of Inquiry framework. To extract the typology the indicators are further summarised and organised into behaviours with respect to the learner providing peer support. These are behaviours exhibited by the participant while carrying out the task of facilitating the learning process for another learner. With a sample size of one MOOC (of one variety) this typology may not be exhaustive and will require review and refinement in future studies. The typology comprises three elements that interact with each other *Openness*, *Re-Contextualisation of Course Content* and *Transactional Exchanges*. The purpose of each element and relevance is discussed below.

Teaching presence is not enacted in isolation, but in concert with social presence hence social discourse forms an integral component in the enactment of teaching presence [37]. Participants utilised a range of social presence indicators to convey their thoughts and ideas. For example, when providing assistance participants sometimes drew from their personal experience of their work in industry or personal knowledge to provide the help required (self-disclosure, personal advice). The diversity of participants enriches the learning process for those requiring support as the responses can be localised to the asker with information that meets or suits their needs. The willingness of responders to share from their personal experience and knowledge demonstrates that participants felt comfortable sharing in the discussion forum. This behaviour, the co-occurrence of social presence with teaching presence, is collectively referred to as *Openness*.

Openness by responders providing peer support was also enacted through the encouragement they provided to other participants for example when they posted their response to discussion prompts. Discussion prompts serve to reinforce the learning of the course content while creating opportunities to further learn through discussion. The acknowledgement and encouragement offered by responders can provide a morale boost and recognition of the efforts of participants who may be undertaking the course in isolation.

Through *Openness*, the interactions of participants are less formal when they inject humour or express emotion in their response. These behaviours demonstrate an openness by participants to freely express themselves. This behaviour can be high in a MOOC where participants are able to comfortably express themselves, or low where participants show restraint or are formal with their interaction providing an opportunity for MOOC facilitators to further investigate if such behaviour was not an expected outcome. The richness of participants background was brought to bear in this MOOC through the support they provided. Diverse participants utilised knowledge from their personal experience to explain course content or answer questions asked by other participants. Participants stepped in to clarify course content which posters had flagged as challenging. They sometimes conducted demonstrations (for example through a worked example), and provided useful illustrations and analogies through which the course material was made accessible to learners requesting assistance.

Responders also frequently shared materials and links to external resources they found useful and relevant to address the query they were responding to. In carrying out these teaching presence indicators, participants were using the tools at their disposal (personal knowledge, industry experience, external content they had found useful) to address a message posted (such as a question or response to

discussion prompt) in a form that makes the course content accessible to their fellow learners. The indicators under direct instruction are collectively referred to as *Re-Contextualisation of Course Content* capturing the various approaches responders utilised to deliver responses to queries. Currently in the typology emphasis is not placed on the method used, rather choosing to identify any approach that can be utilised to make the course content accessible to other learners. This behaviour can be high: where participants are actively engaging with and supporting the learning process of fellow learners, or low: where few participants engage in providing assistance to other participants needing support.

Messages exchanged on the discussion forum appear to be of a transactional nature. The majority of participants provided responses only once or twice, with very few participants posting frequently (more than twice) indicating that participants were not engaged in back-and-forth discussions. They reply one time, or a second time, and may not reply again. The asynchronous nature of interactions on the forum means queries can be addressed at any time by anyone who is available and/or has the expertise to address the query. It may be that when a query receives a response there is little motivation to add on, that a discussion does not ensue, hence discussion threads consist primarily of queries and answers.

The frequent use of vocatives and expressions of appreciation could also indicate the orientation of interactions towards query and response. With the majority of participants submitting just about one query each, submission is thus being received from "new" participants each time. Though responses tend to be short, long-form exploratory answers were observed as well. Participants were not habitual posters on the discussion forum but only stepped in to provide support when seeking answers to their own questions through searching the discussion forum. Thus, this interaction behaviour of participants appears to be transactional in nature: providing support to others while seeking out answers to their own queries. From this the *Transactional Exchanges* behaviour of participants is derived. This highlights the engagement pattern that may be exhibited by participants providing peer support. This behaviour could be high: where exchanges are of one-time assistance, or low: where participants actively deliberate with each other. Where MOOC providers anticipate a level of engagement and interaction by participants, this behaviour in the typology can highlight if this outcome was achieved.

5.2 Typology of peer support behaviours

Table 1 below summarises the extracted behaviours earlier discussed. As an add-on to the Community of Inquiry framework, this table serves to guide researchers on how to map their coding carried out using the Community of Inquiry framework into the peer support behaviours for this typology. In **Table 1** below each *Behaviour* (typology element) maps to a *Coding Categorisation*. The coding categorisation directs how the indicators from the Community of Inquiry framework are to be categorised to derive the behaviour. *Example of Enactment* in **Table 1** below provides an example at the indicator level of the social and teaching presence within the Community of Inquiry framework. The three behaviours are not enacted in isolation but can be acted with one or all of the other behaviours.

In the provision of peer support, each of the behaviours occurs at different levels, for example, where transactional exchange is high, *Openness* by participants may be low. **Figure 2** on the following page captures the interplay between each of the behaviours. At the centre of behaviours is the peer support carried out. The diagram can be read as.

behaviour x influences level of behaviour y due to factors a, b, c etc.

Behaviour	Example of Enactment	Coding Categorisation
Openness	1. Self-disclosure when encouraging other participants 2. Use of humour when offering useful illustrations 3. Sharing personal advice when making explicit reference to outside materials	Overlap of teaching presence and social presence categories enacted by participants
Re-contextualising Course Content	1. Providing valuable analogies 2. Offering useful illustrations 3. Conducting supportive 4. demonstrations 5. Supplying clarifying information 6. Making explicit reference 7. to outside material	Any of indicators within direct instruction category of teaching presence
Transactional Exchanges	1. Brief/short responses 2. Short discussion thread 3. One-time feedback	Through assessment of messages per participant and average length of thread

Table 1.
Typology of peer support behaviours in a MOOC.

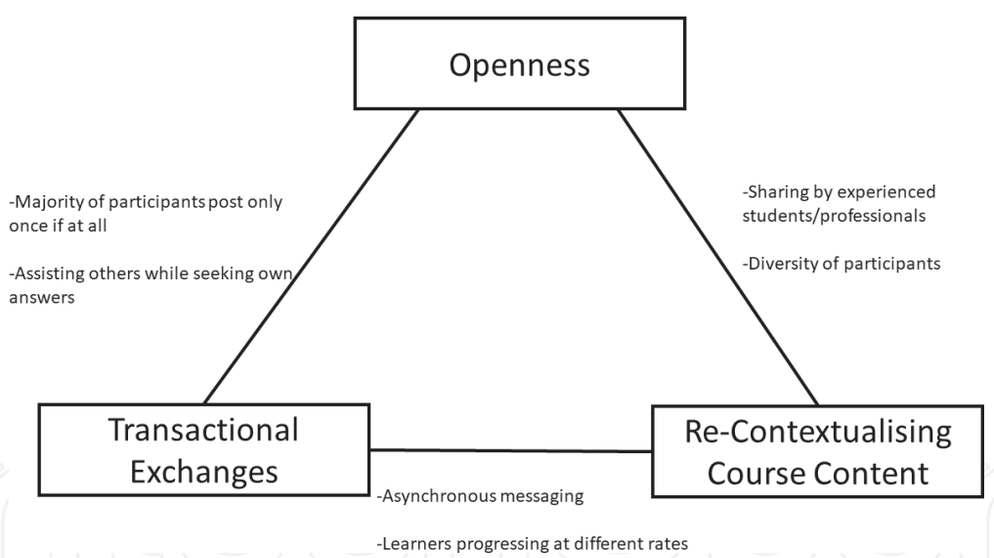

Figure 2.
How peer support was enacted by participants in this study.

For example, *Transactional Exchanges* influence *Re-Contextualisation of Course Content* due to the asynchronous messaging nature of discussion forum. **Figure 2** is not static but depends on the MOOC context where the typology is applied. It summarises the factors at play in the MOOC being studied. Researchers are encouraged to model the typology per their interaction with each other.

5.2.1 Openness

Participants engaged in the discussion forum primarily respond to discussion prompts, and raise questions about challenges they encountered. In their provision of assistance, respondents utilised details from their personal life and experience. These respondents would most likely be professionals taking the course out of

interest. The platform provided a comfortable environment to share their personal experiences. *Openness* in their interaction also allowed respondents to express themselves freely, such as with humour to reformulate course content to "soften" what may have been a hard topic. The messages were informal but polite, usually initiated and concluded with a salutation and focused on the course content. This interplay between *Openness* and Re-contextualising Course Content is captured in **Figure 2** above.

Though participants were open in their interactions, not all types of messages were shared. The primary focus of the exchanges was on the course. Personal details and experiences shared to explain or make the course content accessible were limited to the context of the course. Messages about personal events, such as holiday trips or birthday announcements, were absent. Very few participants were frequent posters with the majority of participants sharing on average only once if at all hence interpersonal bonds that may develop are weak. This highlights the interplay between *Openness* and *Transactional Exchanges* by participants in the Principles of Economics MOOC as depicted in **Figure 2**. When *Transactional Exchanges* are high, social interactions may be limited to superficial and formal expressions, this may be an artefact of participants taking a moment to respond to a fellow learner while seeking out answers to their own questions rather than seeking to engage with other learners. *Openness* by participants is needful in MOOC discussion forums where individually participants share infrequently. Comfortably sharing their thoughts, encouraging other participants or drawing from their experience to support other learners is valuable even if this happens as a one-time activity for the learner.

5.2.2 Re-contextualisation of course content

Participants showed a capacity to explain course materials to fellow learners sometimes utilising information from their personal life and informal social language to reformulate the course content in their responses. On limited occasions, participants provided detailed explanations consisting of several paragraphs drawing on examples from their life or experience in an effort to make a concept accessible to the question-asker reflecting the openness by responders captured by the interaction between *Openness* and Re-Contextualising Course Content represented in **Figure 2**. Responders can localise responses to the requester using references that make the explanation accessible to the recipient, for example, using alternative definitions of content highlighted in the course and worked examples of math-based problems.

The diversity of backgrounds and experiences of participants makes available a pool of knowledge to address a variety of needs that may arise in the discussion forum, they can bring the course to life with their industry experience. Participants voluntarily helping each other can alleviate the load on the course facilitators in providing assistance. Respondents providing assistance also made reference to materials (for example, books) and shared web links to external resources (such as web articles and videos) in their responses. These resources are specific to the query being addressed by providing extra content that precisely addresses the needs of the requester. The respondent may have personally utilised these resources or has assessed them to be relevant to the query.

External resources provided are hence specific and relevant to the needs of the requester. The interplay between *Transactional Exchanges* and *Re-Contextualisation of Course Content* may be influenced by the asynchronous nature of the discussion forum which allows responders to provide feedback when they are in the position to do so, hence responses are not instantaneous, and neither is the feedback if any from the learner receiving the assistance. Participants could have progressed

further with their learning by the time they receive a response at which point the desired period when the information may have been useful (for example undertaking a quiz) may have elapsed.

5.2.3 Transactional exchanges

Exchanges in the discussion forum were not directed towards community building. An exchange was usually initiated by a submission for a discussion prompt or query then immediately concluded in the immediate reply when an answer to the query was provided. Messages in response to discussion prompts were usually followed by expressions of agreement that did not build on the initial post. Hence discussion threads were usually short comprising usually of a question and an answer or a comment. With participants progressing through the course at different rates, follow-ups if at all desired may be a challenge as new questions come through from the large number of participants. It may be that peer support happens sporadically while participants browse through the forum searching for answers to their own challenges.

The high attrition in MOOCs may not couple well with asynchronous messaging as participants drop out over time resulting in one or both participants involved in a discussion not being available to follow up. As discussed under *Openness* above, the enactment of *Transactional Exchanges* can influence the level of *Openness* participants exhibit with *Openness* being low if participants only interact if required rather than actively engaging with each other. The influence of *Transactional Exchanges* on *Re-contextualisation of Course Content* will be the subject of further investigation; it is anticipated that the level of *Transactional Exchanges* may influence the mode of re-contextualisation utilised by participants. For example, will use of analogies and illustrations be high when the level of *Transactional Exchanges* is low? Will participants in a high *Transactional Exchanges* environment utilise reference to outside materials more?

5.3 Utilising the typology

The following procedure is recommended for the application of the typology in future studies. The typology is derived from the Community of Inquiry framework hence utilises the Community of Inquiry coding scheme. Users are encouraged to utilise a whole message of a post for a more robust and consistent coding process. Multiple coding of the same message with different indicators is also encouraged given the expected overlap between social and teaching presences. The typology can be used to compare peer support behaviour across multiple MOOCs. An example of the outcome from the application of the typology is discussed at the end of this section.

To utilise the typology in a research study:

1. Obtain the messages exchanged by participants within the MOOC discussion forum for the period of interest.

2. Messages should be grouped into threads comprising of the head (the initial post being a submission or a question) and ensuing responses to maintain context of messages exchanged.

3. Utilise the social and teaching presences of the Community of Inquiry framework to code each message.

4. Using **Table 1** map the coding from Step 3 to the behaviours in the typology.

5. Tabulate results and summarise the behaviours of the typology as:

$$Behaviour\left(eg.Opennes\right)=\frac{count\ of\ \ messages\ coded\ for\ behaviour}{number\ of\ \ messages\ coded} \quad (1)$$

6. Item 5 above will yield percentage scores. These can be mapped to behaviour levels using the following bands. The score ranges are indicative only, researchers can adapt as required to suit their context (**Table 2**).

7. Repeat for each course under investigation then compare output of summary of codes across the courses.

5.4 A typology use example

An example use of the typology is applied to the theoretical interactions of students (and hence peer support) that may be carried by participants in a cMOOC and xMOOC. Referencing Miyazoe & Anderson's Interaction Equivalency [5] as a benchmarking guide for student–student interaction this example compares the enactment of each behaviour for peer support. Miyazoe & Anderson indicate cMOOCs experience high student–student interaction as learners connect with each other.

Students in cMOOCs are encouraged to contribute resources that are added to the collection shared with other learners. A cMOOC usually has medium student-content interactions because learning is focused on interaction with other students in the network. In the context of the peer support typology, this can be translated as high *Openness* by students in the cMOOCs environment as participants are

Score range (%)	Behaviour level
0–30	Low
30–60	Medium
60–100	High

Table 2.
Mapping scores to behaviour level.

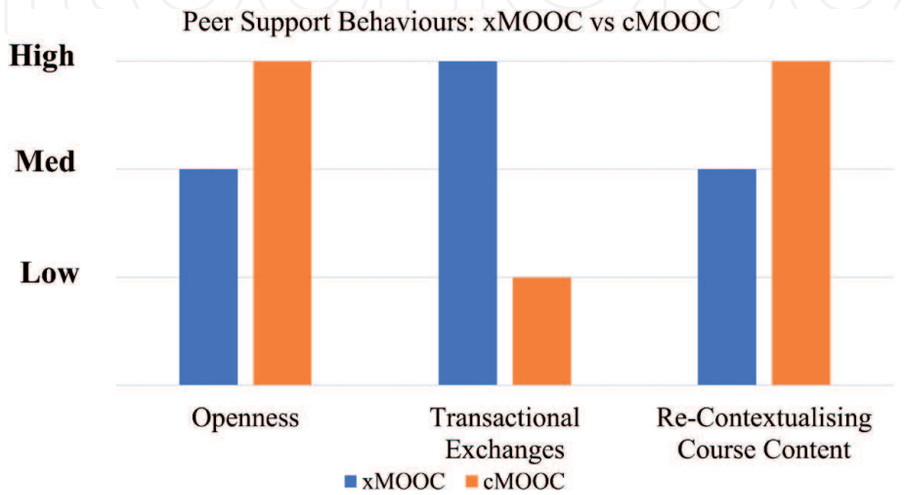

Figure 3.
Example result: Comparing peers support behaviours in xMOOC and cMOOC.

encouraged to actively network and interact with each other to facilitate their learning. As such, *Transactional Exchanges* will be low as students frequently interact with each other. *Re-Contextualisation of Course Content* is high in a cMOOC as learners are encouraged to contribute resources that everyone in the learning network can benefit from.

In contrast, xMOOCs have low-to-medium student–student interaction, as effective tools to support the large number of participants remains a challenge. Student-content interaction is high usually driven by the prestige and experience of the instructor whose lessons have been pre-recorded. From this we can expect that *Openness* by participants providing peer support in an xMOOC will be low-to-medium and *Transactional Exchanges* will be high. Nonetheless, this research study has shown participants providing peer support put in the effort to share extra resources they have found useful or provide answers to their peers asking questions, however, given that a large number of queries go unanswered, *Re-Contextualisation of Course Content* is pegged at medium for xMOOCs. **Figure 3** presents this information in graphical format.

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