In Proceedings of the 1st Workshop on Massive Open Online Courses at the 16th Annual Conference on Artificial Intelligence in Education (2013). Memphis, TN. http://www.moocshop.org

Collaborative Learning in Geographically Distributed and In-person Groups

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Abstract. Open online courses attract a diverse global audience of learners, many of whom might not be self-directed autodidacts with the necessary web competencies to reap the full benefits of such courses. Most of these learners would benefit from increased guidance on how to use MOOCs to enhance their learning. One potential area for guidance is in group collaboration where learners form teams to collaboratively work on assignments. Despite the global scope of these courses, a large proportion of learners live within relatively close proximity of each other, such that in-person collaboration is a feasible option. However, geographically distributed groups of learners are more likely to bring diverse viewpoints to the discussion than learners who live close to each other. Research suggests that the diversity of viewpoints in a group positively affects the quality of collaboration and outcomes. This paper presents evidence based on data from 21 MOOCs that assigning in-person groups is a feasible option, reviews the relevant literature on group collaboration, and proposes concrete research directions.

Keywords: Computer-supported collaborative learning, in-person collaboration, geographic diversity, MOOC

1 Introduction

An increasing number of educators use online, asynchronous computer-mediated communication tools to create massive open online courses (MOOCs). These virtual classrooms attract a global audience of learners (Fig. 1) who join these courses for various reasons, including earning a certificate for completing the course or personal enrichment. The global and massive scale of these courses make them a melting pot for diverse ideas and perspectives: the learner population varies considerably in demographics, cultural background, language skills, personality, motivation, and prior knowledge.

Potentially the most important scholarly question in the midst of the rapid proliferation of open online courses is how learning can be enhanced with MOOCs. No simple answer can suffice, but it is clear that understanding the learner population is critical for developing strategies to foster learning. Borrowing a term from Lévi-Strauss [1], the online learner can be understood as a *bricoleur*–a handy-man or jack-of-all-trades–who cobbles together ways to learn from the plethora of online learning resources. The danger with this notion of the learner is that it is probably over-optimistic, given that many learners are not autodidacts or not "MOOC-ready" in other ways, e.g. not technologically adept. Hence, to ensure equal opportunities to learn, we need to provide guidance to learners to become skilled *bricoleurs* and continuously support them in their *bricolage* learning endeavor.

2 Collaborative Learning

Small group collaboration in and around MOOCs is a particularly fertile ground for increased guidance. The literature on computer-supported collaborative learning can provide theoretically and empirically grounded advice on how to support group collaboration. In addition, the rapid development of the online learning space is providing opportunities for empirical research, unprecedented in scale, to test existing recommendations and investigate novel approaches to guiding group collaboration in a variety of contexts.

Many contemporary MOOCs involve group projects as part of the course, providing learners with the opportunity to collaborate with a diverse set of people and to engage in a process of knowledge building. Group characteristics affect a group's performance, satisfaction, and processes of collaborative learning.

Group formation can follow one of two philosophies: laissez-faire (self-formed) or interventionist (assigned randomly or based on certain criteria). Both approaches raise questions of how groups are selected and the kind of guidance that should be provided from the MOOC interface or other sources.

How should one form groups and guide them to encourage effective and fruitful collaboration? The remainder of the paper addresses this question. Section 3 motivates the distinction between geographically distributed and in-person groups, and presents evidence for the feasibility of assigning local groups. Section 4 reviews relevant literature on small group collaboration that can inform group assignment and guidance strategies. Section 5 proposes concrete research directions to empirically investigate strategies for group assignment and guidance, and proposes a collaboration model that combines geographical diversity and in-person collaboration. Section 6 presents concluding remarks.

3 Geographically Distributed or In-person?

Geographically distributed groups in MOOCs rely on computer-mediated communication (CMC) to work collaboratively on their project. These learners use video conferencing, and synchronous as well as asynchronous textual interfaces, such as email, instant messaging, and word processing applications with real-time collaboration. In contrast, geographic proximity can permit face-to-face (FtF) interaction. Of the two models, FtF collaboration has been associated with a significantly better learning experience in terms of the quality of group discussion and interactions compared to collaboration via asynchronous CMC [2]. This is not surprising given that FtF communication is a considerably more

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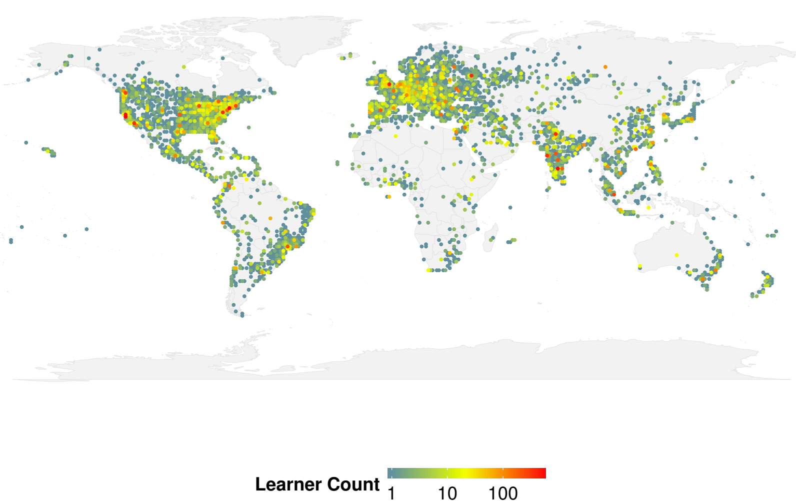
Fig. 1. Geographical location of active (interacted with learning materials) learners averaged over 21 MOOCs with colors representing geographical density of learners in the region. In green, yellow, and red regions, the learner population is sufficiently dense to support in-person collaboration.



expressive medium than CMC.[1] However, no significant differences in learning measured by pre-post tests and self-report were found [2, 3].

In-person groups tend to be self-formed groups of friends, as geographic proximity is positively related to friendship. Such self-formed groups are subject to people's natural tendency to engage with people who are similar to themselves (homophily) [4]. The combination of homophily and the correlation between geography and demographic and other characteristics tends to make these groups even more homogeneous relative to, for instance, randomly-assigned groups. This can be a problem because collaborative learning in heterogeneous groups can be more effective than in homogeneous ones, as the wealth of alternative perspectives sparks innovative ideas [5, 6]. The research on the relationship between group members' friendship and outcomes remains split on whether collaborating with friends is beneficial [7].

The kind of guidance provided to learners partially depends on whether collaboration is in-person or computer-mediated. However, there has been no conclusive evidence that assigning groups to facilitate in-person collaboration in MOOCs is possible at a large scale. While a single MOOC attracts hundreds of thousands of learners, the feasibility of in-person collaboration relies on how many learners live close enough to fellow learners. To investigate the feasibility of in-person collaboration, geographical location data from 21 MOOCs on various topics was aggregated to produce two figures. Conclusions drawn from these data are very likely to be generalizable across MOOCs offered around the same time (late 2011 to early 2013) on MOOC platforms built around weekly video lectures and assignments.

Figure 1 illustrates the density of the active learner population on a world map.[2] Green, yellow, and red regions indicate geographical locations with sufficiently many learners to support in-person collaboration.[3]

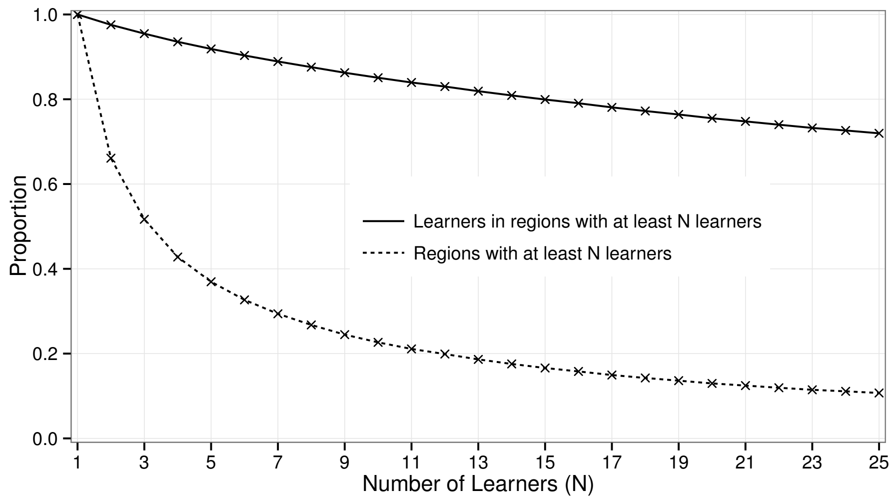
Figure 2 illustrates the geographical density of active learners by the number of learners in the same region. At least three (five) learners live in 52% (37%) of the regions (dotted line). Moreover, due to the high learner density in a few big cities, 92% (85%) of learners live in regions with at least four (nine) other learners taking the same course (solid line). These data suggest that the distribution of learners in most parts of the world would support group assignments that facilitate in-person collaboration.

[1] Interactions in immersive virtual reality are potentially more expressive than face-to-face, but the technology is not yet publicly accessible.

[2] Active learners, a small subset of the enrolled learners, are defined to have used the learning materials at least once.

[3] Geographical location was determined based on users' IP address. A region is defined by all equivalent latitude/longitude coordinates rounded to zero decimal places. This definition of a region is not ideal, because the area within regions varies depending on geographical location, but it provides a rough estimate.

Fig. 2. Geographical topology of active learners (interacted with learning materials) averaged over 21 MOOCs. For 1 to 25 learners (N), the solid line illustrates the proportion of learners in regions with at least N learners and the dotted line illustrates the proportion of regions with at least N learners.



4 Relevant Literature

Scott Page's [8] work on group collaboration indicates that the diversity of viewpoints within a group is more important than the excellence of its individual members. It is reasonable to assume that people's diversity of viewpoints increases with the geographical distance between them, which would suggest that groups should be assigned with greater geographical diversity. However, there is potentially enough cultural diversity present in most major cities to assign groups with diverse viewpoints, while maintaining the geographical proximity to facilitate in-person collaboration.

Related to Page's research, Woolley and colleagues [9] report evidence for a collective intelligence in groups that has little association with the average or maximum individual intelligence of group members, but is highly correlated with the proportion of females in the group and the distribution of conversational turn-taking. While the gender distribution can be addressed by specific assignment of groups, the conversational dynamics within the group can only be influenced indirectly, for instance, by guiding group interactions with written guidelines on turn-taking for in-person groups or with added features in the collaboration interface for distributed groups. For example, online video conferencing tools could include timers for each participant, similar to chess clocks, to encourage balanced participation and turn-taking.

Barron's [10] findings provide further evidence that emphasizes the importance of nuanced process indicators in collaborative learning. She found indicators such as listening to proposals in group collaboration to be predictive of collaboration success, while less process-oriented measures such as group members' prior achievements and how well they generated correct ideas were not correlated with positive problem-solving outcomes. Research on collaborative learning suggests that it is most effective when group members engage in rich interactions, like discussing conceptual explanations rather than providing specific answers. Thus, rich interactions can be encouraged by guiding the collaborative process [11], for example, by providing note-taking templates with prompts that encourage certain behaviors, such as discussing conceptual explanations.

The collaboration process and how it should be guided depends on the communication medium used for collaboration. The expressiveness of the communication medium is a likely moderator of the richness of interactions [12], with FtF enabling more expressive interactions than CMC. However, advances in the learning sciences on collaborative learning with video [13] suggest that augmented CMC (augmented with tools to foster mutual awareness) can yield higher collaboration quality and learning gains than unaugmented CMC. Guidance to learners on the use of these tools, such as when and how to use them effectively, is necessary to maximize their potential benefit to learners. For instance, groups with geographically diverse members should receive guidance on several online collaboration tools, including the types of tasks that each is most suitable for and examples of how to use them effectively.

5 Research Directions

MOOCs provide researchers with a powerful platform for conducting experiments to address questions around collaborative learning in this novel context. The massive scale of these courses combined with randomized controlled field experiments can provide insights into the features of the learning environment and the kinds of guidance that can significantly enhance learning.

The effectiveness of geographically distributed compared to in-person collaboration with different models of guidance could be investigated by assigning half the project groups to maximize group members' geographic distance from each other and the other half to groups close enough to facilitate in-person collaboration. Groups could be randomly assigned to receive different guidance on collaboration strategies and technologies. Outcome measures should capture group performance (project grades and perceived learning), collaboration quality (e.g. Meier et al.'s [14] rating scheme), members' experience, and whether in-person collaboration took place for locally assigned groups. Moreover, a measure of perceived social and cultural group diversity could provide insights into the association between geographic distance and subjective group diversity, which is potentially an important mediating variable.

Beyond the question of how groups are actually assigned, the psychological implications of what learners are told about how their group members were chosen might influence their perception of the group and collaboration experience (framing effect). For example, telling learners that their collaborators were carefully chosen based on their personality and previous experience to promote productive collaboration and original ideas sets positive expectations compared to telling them that groups are assigned randomly.

An implementation that reaps the benefits of geographically distributed and in-person collaboration could be to facilitate collaboration in two steps: locally assigned groups could first collaborate in-person before connecting with a few other groups from around the world to form a larger, more distributed group that discusses the preliminary ideas and continues the collaboration online. This model of collaboration could be tested and adjusted through iterative improvement to optimize the collaboration experience.

6 Conclusion

Providing online learners with guidance, especially those who are not self-directed autodidacts, is necessary to ensure equal opportunity to learn. Group collaboration, where peers collectively solve a task or discuss an issue, is a potentially fruitful setting for increased guidance. Learning from and with peers to complement learning from the instructor is becoming increasingly important in online learning due to rapidly growing student-to-teacher ratios. It is therefore critical that collaborative learning is enhanced by providing learners with appropriate guidance.

What kind of guidance to provide will partly depend on the type of learner interaction. This paper argues that there is an important distinction between groups that have the potential for face-to-face communication and those who do not, especially as education moves out of brick-and-mortar institutions where students are all geographically accessible.

7 Acknowledgments

The author would like to thank Clifford Nass, Roy Pea, and two anonymous reviewers for their feedback on an earlier draft of this paper and Stanford's Office of the Vice Provost for Online Learning for supporting this research.

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