Adapting Collaborative Chat for Massive Open Online Courses: Lessons Learned

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Abstract. In this paper we explore how to import intelligent support for group learning that has been demonstrated as effective in classroom instruction into a Massive Open Online Course (MOOC) context. The Bazaar agent architecture paired with an innovative Lobby tool to enable coordination for synchronous reflection exercises provides a technical foundation for our work. We describe lessons learned, directions for future work, and offer pointers to resources for other researchers interested in computer supported collaborative learning in MOOCs.

1 Introduction

The field of Computer Supported Collaborative Learning (CSCL) has a rich history extending for nearly two decades, covering a broad spectrum of research related to learning in groups, especially in computer mediated environments. In this paper we describe the initial stages of a research program designed to import findings from a history of successful classroom research in the field of CSCL to the challenging environment of MOOCs.

In order to support the growth of student discussion skills, it is necessary to design environments with affordances that encourage transactive behaviors and other valuable learning behaviors. The most popular approach to providing such affordances in the past decade has been that of script-based collaboration [2, 7, 6]. A script is a schema for offering scaffolding for collaboration. Some typical forms of scripts come in the form of instructions that structure a collaborative task into phases, or structured interfaces that reify certain types of contributions to the collaboration. Prior work on dynamic conversational agent based support built on a long history of work using tutorial dialogue agents to support individual learning with technology [11, 10, 5, 12].

The MOOC environment presents a number of challenges that must be addressed in order to introduce synchronous collaboration opportunities into MOOCs. From a research perspective, interesting challenges include exploration of group composition questions with MOOC student populations, which are far more diverse with respect to culture, age, educational level, and goals than typical classroom populations. Another interesting methodological challenge is the lack of control over the context. In a classroom context, a certain amount of time may be set aside for an activity, and students can be expected to be present for the whole activity. In a MOOC, students may come and go as they please, and since they may be logging in from anywhere, any number of events could interfere with the task proceeding as planned. While a collaborative task may have been carefully designed with roles for each student to perform in a serious learning task, those roles may play out differently than intended in cases where the students who take on those roles are actually multiple students, students with a seriously inadequate preparation for the task, or even students with far more expertise than anticipated.

Before any of these issues may even be touched upon, a number of more practical issues must be addressed first to lay a foundation for this research. A major challenge in MOOCs is coordination. Whereas in a face-to-face course and traditional small-scale online courses, students can be expected to be amenable to stipulated meeting times, students in MOOCs typically come from different time zones around the world. The great majority of students make use of resources at their convenience, when they happen to have time to log in, rather than planning ahead and arriving at a scheduled time. The sheer numbers of students make it challenging to coordinate plans for meeting times. Furthermore, not all students adopt the same orientation towards following instructions in general or engaging in a task as presented in particular. Some students may click on an activity in an exploratory or playful fashion rather than with a serious intention of completing the activity. Thus, there is a danger of introducing students into a group in a way that engenders conflict or mismatched expectations.

In the remainder of the paper we first introduce the technical approach we adopted in an initial MOOC deployment. We then summarize our main results and lessons learned. We conclude with directions for continued work and resources to share with the community. Further discussion of the results of our deployment can be found in two separate publications [3, 4].

2 Technical Approach

In order to gain a deeper understanding of the problems that may arise from synchronous collaborative activities in MOOCs, we integrated a chat environment with interactive agent support in a recent 9-week long MOOC on learning analytics (DALMOOC) that was hosted on the edX platform from October to December 2014.

In order to facilitate the formation of ad-hoc study groups for the chat activity, we make use of a simple setup referred to as a Lobby. The Lobby introduces an intermediate layer between the edX platform and the synchronous chat tool. Even though the Lobby allows groups of arbitrary sizes to be formed, we decided that agent-guided discussions in groups of two students are the suited setup in the context of this MOOC. Students enter the Lobby with a simple, clearly labeled button click integrated with the edX platform. In order to increase the likelihood of a critical mass of students being assigned to pairs, we suggested a couple of two hour time slots during each week of the MOOC when students might engage in the collaborative activities. These timeslots were advertised in weekly newsletters. However, the chat button was live at all times so that students were free to attempt the activity at their convenience. Upon entering the lobby, students are asked to enter the name that will be displayed in the chat. Once registered in the lobby, the student waits to be matched with another participant. If they are successfully matched with another learner who arrives at the Lobby within a couple of minutes to interact with, they and their partner are then presented with a link to click on to enter a chat room created for them in real time. Otherwise they are requested to come back later. A visualization is presented to them that illustrates the frequency of student clicks on the button at different times of the day on the various days of the week so that they are able to gauge when would be a convenient time for them to come back when the likelihood of a match would be higher. In the beginning of the course, the graph was based on experiences with past MOOCs while it was later updated with real data from the DALMOOC logs.

When the successfully matched students click on the provided link, they enter a private chat room. This chat setup has been used in earlier classroom research [1]. It provides opportunities for students to interact with one another through chat as well as to share images. The chat environment furthermore has built-in support for conversational agents who appear as regular users in the chat.

In contrast to our earlier work where we support collaborative chat dynamically with conversational agents triggered by real time monitoring of student interactions [1], we employ statically scripted agents in DALMOOC which guide the students with course-related discussion questions (Figure 1). Even though the scripts are linear, the agent prompts are not strictly timed but rather allow the students to interact in their own pace and take as much time as needed to discuss the given topic. Once a team wants to proceed with the discussion, they can move on with the *We're ready*-button. The agent will proceed with the next prompt as soon as both students indicated that they are ready. In case the students never signal their readiness, the agent will inquire after a predefined timeout in order to move forward with the discussion and avoid the students to lose focus.

3 Main Results

Though we encountered many challenges during the DALMOOC deployment, the main results suggest value added by the intervention. In order to begin to assess the added value of integrating reflective chat activities with a MOOC platform, we compared our synchronous collaborative chats with two other communication contexts, namely Twitter and the MOOC discussion forum [3]. What we found is that different subpopulations of learners within DALMOOC tended to gravitate towards different communication contexts. Furthermore, each context was associated with its own unique profile in terms of content focus and the nature of the discussion. The chat conversations showed the highest average of reflective contributions across all the platforms we observed. Furthermore,

Prompt 1	In this collaborative activity, we will reflect on what you have learned about the field of learning analytics. First, take a couple of minutes to introduce yourselves.
Prompt 2	Now that you have viewed the videos, share what you found most interesting about learning analytics.
Prompt 3	Regarding learning analytics tools, did you find the classifications of a) proprietary/open source and b) single functionally/Integrated suites to be useful? How would you improve these classifications to make them more relevant to educators starting with analytics toolsets?
Prompt 4	Reflect on the structure of the dual-layer structure of the course. Describe your experience of coming to understand different course elements.
Prompt 5	Now this activity has come to an end. Thanks for a great chat! Why don't you exchange contact information to stay in touch?

Fig. 1: Agent prompts for the collaborative chat activity in the first week

the one-on-one conversations in Bazaar exhibit a strong constructive character where reflective statements are not merely precompiled by each student and then exchanged, they are rather collaboratively constructed in the course of the conversation. We see ample evidence within contributions across media pertaining to social connection that these MOOC learners crave continuing social engagement with other individuals participating in their MOOC course. The analysis suggests that there is value in providing a diverse set of discussion contexts but that it creates a need for greater efforts towards effective bridging between media and channeling of students to pockets of interaction that are potentially of personal benefit.

We also used a survival analysis to evaluate the impact of participation in collaborative chats on attrition over time in the course [4]. The results suggest a substantial reduction in attrition over time, specifically a reduction by more than a factor of two, when students experience a match for a synchronous collaborative reflection exercise. Nevertheless, these results must be treated with some caution as we experienced significant difficulty in managing the logistics of matches. Even with 20,000 students enrolled in the course, some students had to make as many as 15 attempts to be matched with a partner before a match was made.

4 Lessons Learned

In this first deployment study, we learned valuable lessons that will help to improve our experimental setup in future cycles of our iterative design based research process. In this section, we first describe the main lessons learned and then briefly discuss future directions we are planning to take.

Integrating a synchronous collaborative activity in an inherently asynchronous learning environment used by students in different time zones was one of the greatest organizational challenges to overcome. As mentioned earlier, we attempted to alleviate the problem by introducing dedicated chat hours to increase the likelihood of students getting matched with each other. Nevertheless, the majority of students who entered the lobby could not be matched with a chat partner within 10 minutes. This was a frequent cause of frustration which lead to students abandoning the chat activity in the course of the MOOC.

Since students are matched randomly in pairs for each chat activity, their interaction is naturally limited to a single chat session. Whenever they return to the chat, they will be connected with a different student. From the logs we have seen that especially after longer discussions, students expressed the desire to connect with each other and continue the interaction beyond the chat activity. On several occasions, they exchanged contact information in order to reconnect for further collaboration. However, the intervention did not provide any support for continued social engagement between paired learners.

We are currently developing new strategies for tackling these problems in future deployments of the intervention. First, we will employ a single-chatroom setup that allows students to directly enter at their own volition without the need for explicit matchmaking. The agent in this continuous chatroom will then adapt to the student population in the room at any given time. For instance, a single user in the room would be prompted to reflect on the course material on their own. Once a second user enters, the agent summarized the reflection of the other student and composes a discussion topic for the two users to collaboratively reflect on. The agent keeps track of the topics already discussed by the users currently present in the room to avoid redundant prompts.

Second, we will explore a scheduling system that allows students to sign up for a set of predefined timeslots. This approach has proven effective for multi-party voice chats in MOOCs [8]. Even though the necessity to schedule discussions ahead might negatively affect the engagement of users who merely interact with the MOOC on an ad-hoc basis, the approach could nevertheless help to reduce overall friction by offering an easier transition from the asynchronous nature of the MOOC to the synchronous nature of the chat.

5 Conclusions

This research was motivated by the goal to import best practices and technologies from the field of Computer Supported Collaborative Learning into MOOCs [9]. It is part of a broader effort drawing from two decades of research in Computer Supported Collaborative Learning, where we are working to design an extension of the edX platform to enhance instructionally beneficial discussion opportunities available to students[1]. We are partnering with edX as a satellite collaborative, seeking to involve researchers and developers from multiple universities, foundations, and industrial organizations. Our long term vision is to seek to leverage insights and methodologies from the field of Human-Computer Interaction more broadly and encompassing both synchronous and asynchronous communication very broadly. Our vision includes text, speech, and video based interactions, instrumented with all sorts of intelligent support powered by state-of-the-art

[1] `http://dance.cs.cmu.edu`

analytics and leveraging language technologies and artificial intelligence more broadly in order to offer contextually appropriate support.

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