ProjectLens: Supporting Project-based Collaborative Learning on MOOCs

Hao Fei Cheng , Bowen Yu , Yeong Hoon Park , and Haiyi Zhu

GroupLens Research
University of Minnesota
{cheng635, yuxxx856, park1779, zhux0449}@umn.edu

ABSTRACT

Team project, which emphasizes collaborative learning in a project-based context, is one of the most commonly-used teaching and learning methods in higher education classrooms, but is not well-supported on existing Massive Open Online Course (MOOC) platforms. In this paper, we present ProjectLens, a MOOC supplement tool that supports team projects building and collaborative learning on MOOC platforms like Coursera and edX. In addition, ProjectLens is a research tool that provides opportunities to conduct large-scale field experiments to study how different factors influence the effectiveness of collaborative learning. We illustrate how ProjectLens can achieve these two goals in a case example.

Author Keywords

Massive Open Online Courses; MOOCs; Collaborative Learning; Group Collaboration

INTRODUCTION

Massive Open Online Courses (MOOCs) have steadily gained popularity in recent years because of their ability to provide easily-accessible and high quality education to students all over the world. Many current MOOC platforms (e.g. Coursera and edX) provide good support for individual learning activities, such as watching pre-recorded lecture videos, reading documents, and completing individual assignments, quizzes and exams, but have very limited support for collaborative learning among students.

Collaborative learning is defined as two or more people learning together [3]. Prior research has demonstrated that collaborative learning is an effective learning technique, because it can generate extra activities (e.g., explanation, disagreement and mutual regulation), trigger learning mechanisms (e.g, knowledge elicitation, internalisation, reduced cognitive load, and critical thinking), and therefore improve learning outcomes [4][3]. However, current collaborative learning activities on MOOCs, such as forum discussion and peer-grading do not have the necessary collaboration depth to generate such learning activities and trigger important learning mechanisms.

Team projects emphasize collaborative learning in a problem-based context, and are one of the most commonly-used teaching and learning methods in higher education classrooms [14] [8]. When teams of students spend tens or hundreds of hours together to solve real and meaningful problems, they gain a deeper understanding of course materials. This helps them acquire higher learning skills including cooperative ability, critical reasoning, creative thinking, responsibility, and communication [9]. To the best of our knowledge, there is no system-level support for team projects on existing MOOC platforms.

In this paper, we present ProjectLens, a tool that aims to support project-based collaborative learning for teams on existing MOOC platforms, including Coursera and edX. In addition, we believe that ProjectLens will also allow researchers to access interesting data to examine important research questions related to computer-supported collaborative learning.

OVERVIEW OF PROJECTLENS

ProjectLens has two primary goals:

1. ProjectLens is a MOOC supplement tool that supports team projects and collaborative learning on the existing MOOC platforms. ProjectLens can be integrated quickly with MOOCs that involve collaborative learning.
2. ProjectLens is a research tool that provides new opportunities to conduct field experiment and answer important research questions on online group learning.

AS A SUPPORT TOOL

ProjectLens provides the following key features that allow instructors to easily set up team projects which are not well supported by the current MOOC platforms. The most important function that ProjectLens supports is team formation, which assigns students into groups. Figure 2 shows how the instructors can select which attributes (e.g., gender, age, time

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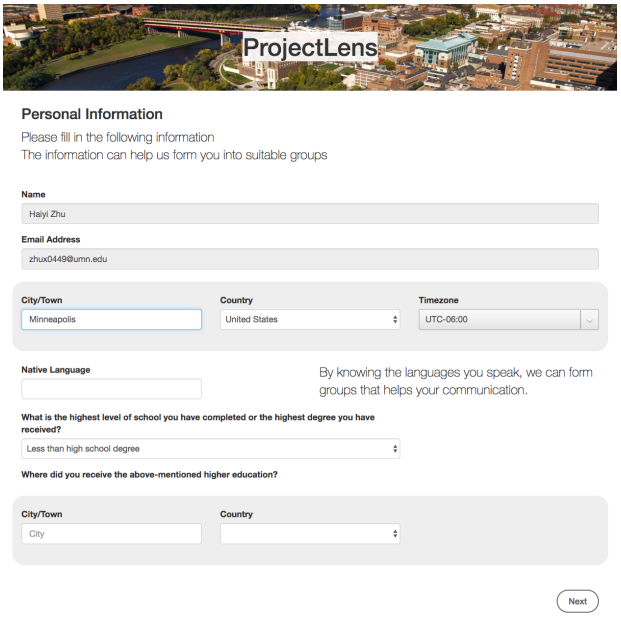
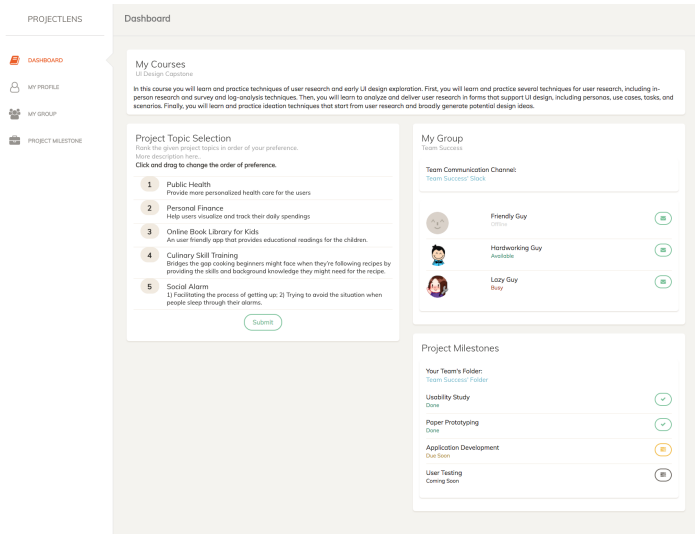


(a) During the signup stage, students fill out a survey about their demographic information and attributes. ProjectLens will put students into suitable groups based on the algorithm selected by the instructor.



(b) The main dashboard helps students collaborate with their group members and motivates their group communication. Students can interact with their group members, discuss and vote on project ideas, and update their project progress using the platform.

Figure 1: The user interfaces of the ProjectLens student platform.

zone, country, prior experience) they want to use to group the students with. Additionally, instructors are required to decide the team size. Moreover, ProjectLens recommends the instructor to upload detailed instructions for the team project, set up a time window for students to register for team projects, and provide a deadline for uploading deliverables (e.g. project report).

As shown in Figure 1, students will have to navigate to ProjectLens to sign up for a team project and fill out a survey (i.e. reporting their demographic information, geography information, prior research experience, and contact information) during the signup period. After the end of the signup period, ProjectLens will analyze the survey data and group students into different teams based on the criteria the instructors set up. Students will be notified of the grouping information and have access to their team members' information on the ProjectLens page. They are encouraged to start communicating and working with their team members using the communication channels provided by ProjectLens.

ProjectLens can be integrated with Coursera and other MOOC platforms through the Learning Technologies Interoperability (LTI). LTI is a specification developed by IMS Global Learning Consortium to establish a standard way of integrating external learning applications with learning platforms [1]. Students can directly access ProjectLens pages from the MOOC interface. In other words, students do not need to navigate to an external website.

[1]https://www.imsglobal.org/activity/learning-tools-interoperability

AS A RESEARCH TOOL

For over twenty years, researchers have been studying under what circumstances collaborative learning is more or less effective [13]. Potential variables that could influence the effectiveness of collaborative learning include size of the group, composition of the group, nature of the task, communication media, and so on. Moreover, these variables often interacted with one another on affecting the interaction between people and the collaboration outcomes [3]. Drawing a comprehensive picture of the effects of these factors requires a very large sample size that is difficult to obtain in traditional context.

ProjectLens provides a unique opportunity to access a large participant pool, given the success and popularity of the current MOOC platforms. Since its launch in 2012 to September 2015, Coursera has accumulated 15 million registered learners [6]. From Summer 2012 to Fall 2016, HarvardX and MITx attracted 2.4 million unique learners. On average 1,554 unique new participants enroll each day [2]. ProjectLens has the potential to run field experiments on hundreds of thousands of students.

CASE EXAMPLE

Supporting "UI Design Capstone" on Coursera

ProjectLens will be used to support Coursera class "UI Design Capstone". "UI Design Capstone" is the final course of the UI Design Specialization on Coursera, provided by the University of Minnesota. In the eight weeks, students engage in a team project which requires them to apply and combine the skills they have learned in the previous courses in the specialization.

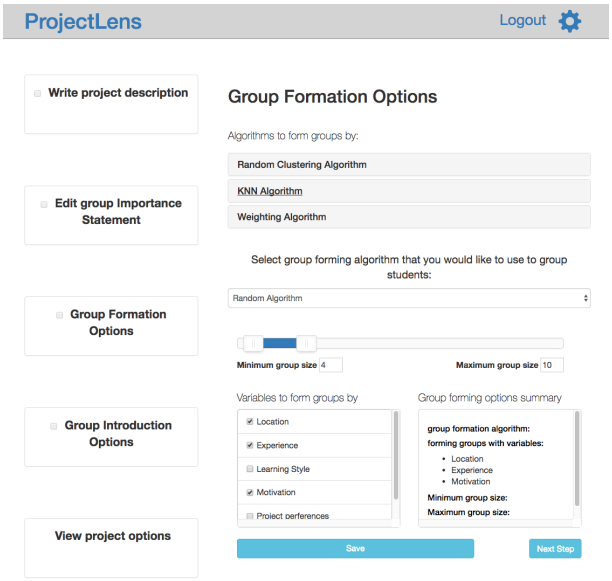


Figure 2: The user interface of the ProjectLens instructor platform. Instructors can customize the group formation process, which includes tweaking the clustering algorithm, group size and group formation variables.

Students will work in groups in designing the UI solution to a selected project.

Studying the effects of geographical locations

As MOOCs are providing education at a global scale, students come from all over the world. For example, in the class "Circuits and Electronics" on edX, 155,000 students come from 194 countries spanning multiple time zones [1]. This demonstrates a huge diversity in the geographical locations of the students on MOOCs.

The geographical location is an important factor that can influence the team formation and team composition, and thus can affect the performance of team collaboration. However, geographical location is less studied in prior research examining team work and team formation in education setting [10] [7], as these studies often examine co-located students in the traditional classroom environment.

The geographical location of team members has two functional dimensions that could influence the effectiveness of collaborative learning — *culture* and *timezone*. Both factors affect how well a MOOC team could collaborate. Research has shown that cultural diversity had a positive influence on the group decision-making, but had a negative influence on effective communication [12][11]. Similarly, time zone differences could be a problem for communication, but could also be an asset — projects could literally zip around the globe with work being completed 24 hours a day [5].

We designed a 2 X 2 experiment (shown in table 1) to examine how culture and timezone affects the effectiveness of collaborative learning. We will recruit students from the "UI design capstone" class to participate in the study. Students can

Table 1: Experimental design to examine the effects of geographical location on collaborative learning.

		Timezone	
		Same - 0	Different - 1
Culture	Uniform - 0	00	01
	Diverse - 1	10	11

voluntarily join the research study, when they sign up their team projects on ProjectLens.

We will collect the location information (including the culture and timezone) of the students who joined the research study. These students will be assigned into one of four types of groups: 1) diverse culture and same timezone, 2) uniform culture and same timezone, 3) diverse culture and different timezone, or 4) uniform culture and different timezone. We define a group with members from more than two cultures as "diverse culture" and otherwise as "uniform culture". We define "different timezone" as a group with timezones difference between two members greater than 3 hours, otherwise as the "same timezone".

We will regularly monitor the performance of each group and evaluate the effectiveness of collaborative learning on the following four aspects:

1. The learning outcome of the group: we will evaluate the final milestone of the group.
2. The communication frequency and effectiveness: we will monitor how often each team member communicates in a group and use semantic analysis to analyze whether the team communication environment has been positive or negative.
3. The dropout rate and free-rider rate: we will monitor if any group member does not contribute to the group project or does not participate in the group communication.
4. The satisfaction of each group member: we will have each group member rate their satisfaction with the project experience and evaluate their teammates after the project.

DISCUSSION AND FUTURE DEVELOPMENTS

We will complete the case study on the effects of geographical locations on collaborative learning. Data will be collected from March 2017 to July 2017, in a span of five months. A new session of the class starts every two weeks and we are expecting to collect data from around 1000 students and 200 student groups.

The future development involves providing more data visualization for analysis. We plan to release ProjectLens as an open source platform to help other MOOCs incorporate collaborative learning into their courses.

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