Identifying Factors that Affect Team Formation and Management in MOOCs

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Abstract. The integration of Computer-Supported Collaborative Learning (CSCL) in Massive Open Online Courses (MOOCs) is a challenge that several research projects are trying to address. However, team formation and their subsequent management in MOOCs is a complex task, that depends on multiple factors, both pedagogical and technological. This paper analyzes the factors that influence team formation in MOOCs, as an initial step towards our overall goal of designing automatic tools to support the dynamic management of teams in MOOCs.

Keywords: Collaborative Learning, MOOC, Group formation, Teams.

1 Introduction

Collaboration enriches learning with social and cognitive dimensions that maintain student motivation and elicit verbal communication [1]. The potential benefits of Collaborative Learning (CL) and the corresponding ICT support (CSCL) have been largely explored at contexts of small and medium scale. However, the effective use of CSCL at large scale, such as in MOOCs, faces additional problems [2]. MOOCs have been strongly criticized due to their instructional quality [3], and several problems regarding the introduction of CSCL in these contexts have been detected [4]. Therefore, it would be highly desirable to take advantage of the participation of a high number of students and other benefits of MOOCs [5], while addressing the challenges that have already been detected.

Some of these challenges are related to MOOC specific features that hinder a wide and effective adoption of CSCL in these contexts. For example, the massive and substantial variation of the scale, due to the flexible enrollment and the behaviour of the students during the course, hamper group formation. Also, the students' eventual disengagement and the self-paced character of the majority of MOOCs strongly affect the composition and structure of teams, and make their management more complex.

The group formation problem has been explored by several researchers. For instance, Muehlenbrock explored the use of the student's' profile [6]; Martin et al.

employed data related to the student's' learning style [7]; and Ounnas et al. used semantic data and clustering techniques in order to provide automatic or semi-automatic support to group formation [8]. However, these studies were not made in a MOOC context, and therefore their conclusions are not directly applicable without a deeper analysis of the particular features of these new environments.

The problem of applying CSCL in MOOCs has been addressed by other researchers, but there is little previous work that studies the issue for group formation [9]. Moreover, to the best of our knowledge, the dynamic restructuring of the teams after the initial enrollment, during the course enactment, has not been studied yet. Regarding the group formation problem in MOOCs, Sinha focused on the use of Social Network Analysis and Machine Learning techniques [10], while Zheng et al. used random and survey-based algorithms for group formation [11]. Also, the work carried out by Spoelstra et al. analyzed team formation in project based learning, taking into account the background knowledge, preferences, and personality of the students [12]. The existing variety of perspectives suggests that there are many factors that can be considered for group formation. Moreover, as aforementioned, team management problems are expected to occur in MOOCs (i.e. high rate of students' disengagement and dropout), even if such groups were formed using sound criteria at enrollment time. Thus, a method for dynamic group management (initial formation and restructuring) might contribute to the solution of the aforementioned problems.

We are interested in the general research problem of *how automatic or semi-automatic tools can help teachers*[1] *create and manage teams in MOOC contexts*. The aspects that can be taken into account for the development of these supporting tools are numerous and can be assigned and mapped to different categories and levels of abstraction. For example, some of these aspects refer to grouping criteria that the teacher could apply while designing the course, whereas others correspond to computational techniques needed to implement group formation. We present in this paper our inital attempts to identify and organize the different factors that could be taken into account for the design of the envisioned group formation tools for MOOC.

The rest of the paper is organized as follows. First, we present an analysis of the MOOC features that directly influence group formation. After that, we propose an initial classification of factors to be considered for creating and managing groups in MOOCs, outlining the most important conclusions obtained so far and pointing to the future steps of our ongoing research.

2   Teams in MOOCs Context

MOOCs present some features that hamper instructors' CL orchestration tasks and particularly team management. Due to their **openness**, there are no access requirements and registration is usually free or very affordable. Thus, students

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[1] In this paper, we use the term *teacher* to refer to the different stakeholders involved in the creation and management of MOOCs - e.g., instructional designers, lecturers, teaching assistants, etc.

enrolled in MOOCs are typically very heterogeneous and, in some cases, have low motivation, which leads to high dropout rates [13]. The **online** feature favor enrollments all over the world. Thus, students are geographically dispersed, with different time slots and mobility, which hinders synchronous collaboration. The **massive** number of students enrolled in MOOCS not only complicates team orchestration but may also condition the techniques and algorithms used to implement the desired automated grouping tools. Moreover, the significant scale variations can influence over the eventual team structures already created. Furthermore, the intrinsic **course** characteristics (i.e., contents, duration) also have significant impact in the team formation problem because such features could predetermine the nature of the collaborative tasks. Each course offers an independent subject and its content is usually segmented into short units, having a calendarized design, but permitting self-paced learning [14, 15]. This lack of tightness and high flexibility of this type of courses induce us to believe that a dynamic management and restructuring of the team's structures is essential.

Currently, there are some MOOC platforms that allow the creation of teams in this kind of massive courses. Such platforms allow teachers decide if (i) students are automatically assigned to groups depending on the students' enrollment order (e.g., Canvas), (ii) students are in charge of creating and managing their own groups (e.g., NovoEd), or (iii) groups are manually configured by teachers (e.g., edX). However, to the best of our knowledge, none of the existing MOOC platforms supports teachers in the creation and dynamic management of groups based on the students characteristics and progress during the course enactment.

3   Classification of Grouping Factors in MOOCS

The process used for the creation of the proposed classification scheme consisted in an iterative literature survey that aimed at satisfying the following objectives:

– Identify the main aspects and perspectives about the **Group Formation Problem in CL**.
– Detect **MOOC features** that may influence group structures.
– Understand the challenges related to the integration of **CSCL in MOOCs**.
– Analyze prior perspectives of the research groups that have tackled the **Group Formation Problem in MOOCs**.

With the obtained information we identified categories or levels of abstraction. Then, we generated, in an iterative process, a classification schema including two different perspectives (see Fig. 1): (a) a hierarchical decomposition; and (b) various levels of abstraction (from pedagogy to technology) perspective.

Fig. 1 depicts the classification and the main factors in each category. These categories are:

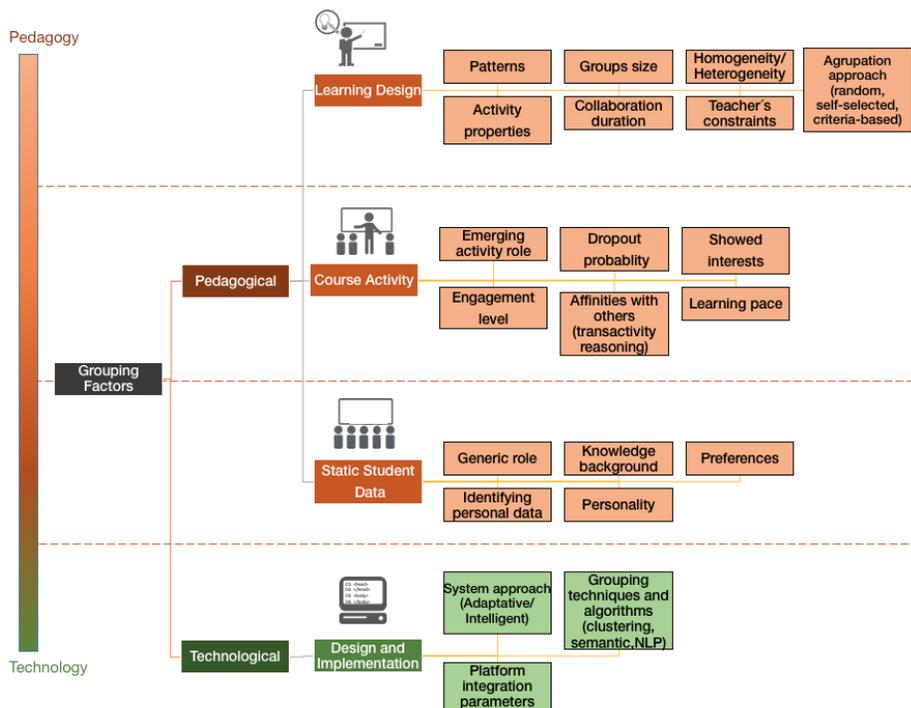– **Learning design factors** are typically selected by the teacher when designing the course.

Fig. 1. Classification of factors influencing the creation and management of groups in MOOCs under hierarchical and level of abstraction perspectives.

- **Course activity factors** are dynamic and usually emerge during the course.
- **Static student data factors** are captured at the beginning of the course (i.e. in the enrollment profile or in a student survey) and their value is not updated or monitored during the course enactment.
- **Technological (design and implementation) factors** have to be considered when the rest of factors are embedded in an automatic or semi-automatic software tool.

The proposed classification shows that pedagogical factors play a highly significant role in the formation of groups in MOOCs, involving 18 out of the 21 categories identified. Moreover, the factors related to the course activity are specially important because they affect the dynamic restructuring of the teams. For this reason, we believe that course activity factors are quite relevant to reach our main goal: the development of supporting tools that can be used by teachers in the formation and dynamic restructuring of teams. We plan to test and further refine the initial classification described in this paper by interviewing experts in CL with experience in designing MOOCs.

Acknowledgements

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