Encouragement of Collaborative Learning Based on Dynamic Groups

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Computer-Supported Collaborative Learning (CSCL) is an approach to learning based on support of information and communication technologies. Research in CSCL can be grouped into systematic and dialogical approaches [2]. The systematic approach concerns the creating of models how the specific features of technological systems support or constrain collaboration, reasoning, knowledge representation, and structure of discourse [1]. On the other hand, the dialogical approach considers learning as a social-based activity.

We deal with the dialogical approach, especially with encouragement of students in collaborative learning by creating dynamic short-term study groups and design a collaboration platform which allows these groups to collaborate efficiently. The reason to follow this goal is the fact that we do not know what makes collaboration really effective.

The basic idea of our method for group formation is derived from Group Technology (GT) approach. According to Selim, et al. [3] GT is an approach to manufacturing and engineering management that helps manage diversity by capitalizing on underlying similarities in products and activities. GT seems to solve similar problem as we have to solve to reach our goal. Thus, we developed a new method inspired by *Group Technology* techniques.

The proposed method consists of two main processes. *Group Formation* takes different personal or collaborative characteristics as inputs and creates study groups. Personal characteristics can be student's knowledge, interests, or any other personal characteristics (e.g. age, gender). We can obtain these characteristics from many sources, such as existing user models, social networks or questionnaires. Furthermore, characteristics can be collaborative, such as friendship with other students or collaborative behaviour. *Collaboration* allows students of created groups to participate on task solving via a collaboration platform called PopCorm which provides

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appropriate collaboration tools together with functionality for observation groups' dynamic aspects which are used as one of inputs in the proposed method.

Evaluation of our method consisted of a long-term experiment which was realized during summer term as a part of education on the course Principles of Software Engineering at the Slovak University of Technology in Bratislava. 106 students in total participated in 208 created groups. 3 613 activities are recorded during task solving.

Table 1. Comparison of achieved results during the second phase of the experiment.

Groups created	Average evaluation	Feedback
By the proposed method	0.459	4.01
By the reference method (k-means clustering)	0.392	3.55
Randomly	0.422	3.29

The 8-dimensional evaluation of the groups created using our method was compared with a reference method (k-means clustering) and randomly created groups (see Table 1). Groups created by our method achieved the most effective and successful collaboration in comparison with the other two types of groups. We employ ANOVA statistical model to evaluate significance of achieved results and we got p-value 0.0048. Thus, the achieved results can be considered as highly significant. Additionally, students have provided a higher explicit feedback in these groups.

Our method is not limited only to the CSCL domain. It can be easily applied in other domains where dynamic groups should be created according to different user characteristics. We have successfully applied the proposed method during the experiment in collaborative learning by creating dynamic short-term study groups, which showed high potential of proposed method. It would not be possible to evaluate our method for group creation without the collaborative platform PopCorm which provides students the appropriate environment for effective task solving and automatic identification of their activities.

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