

Group Dynamics in Socially Aware E-Learning

Selänne L., Kurhila J.

Department of Computer Science, University of Helsinki, Finland
lena.selanne@helsinki.fi

Abstract: Group dynamics play an important role in collaborative learning. Especially in e-learning it is important to pay attention to the formation of the groups as e-learning often lacks some social information typically used implicitly in group formation. This paper presents a study of two university-level e-learning courses in computer science. These collaborative courses were made up of self-organized groups. The group formation is studied in a quantitative manner, taking into account both the groups' internal dynamics and individual students' perspective. The groups differed in size and in group composition (i.e. heterogeneity in the level of achievement). The students differed in the number of study companions and in the selection of group members. However, none of these differences leads to variations in academic performance.

Keywords: group dynamics, e-learning, higher education

1. Introduction

Collaborative learning has become popular and widely used in e-learning, both in synchronous and asynchronous forms (see e.g. [1, 10]). Collaboration is often conducted in small groups. The formation of the groups and the group dynamics are challenging for both the students and the tutors [8]. Like groups in general, small groups in web-based learning have different kinds of roles from leaders to outsiders [3]. During a course, participants learn to know each other better and the trust between the participants and feelings of togetherness grow [2]. With a growing group size, the structure of the group, the importance of leadership, and the solidarity are bound to change. One of the tutors' tasks is to recognize the different roles in the group and help students to feel at home in the virtual community [3]. In order to enhance the acquisition of valid interpersonal skills in higher education, learning can be organized to encourage students to form small groups and to study with many different study companions. The work load is easier to divide in small groups.

We have studied two university-level courses using quantitative approach by measuring the group size and the number of study companions, and comparing them to the grade points a student received. We have also studied whether publishing the points students received transparently to everyone already during the course progression has an effect to the selection of group companions. This is achieved by calculating the point-wise performance level of student's fellow group members and by the heterogeneity in group composition, and comparing them to the student's points received.

2. Test Setting

The courses we have studied were given in 2003 and 2005 at the Department of Computer Science, University of Helsinki, Finland. The name of the master-level course was

“Computer Uses in Education” (CUE). The structure of the courses remained mostly the same between the courses. The pedagogical approach was student-centered collaborative learning with peer-support. Except the first orientation lecture, the whole course was a pure web course. There were two online tutors in the courses, which were the same for both the courses. The roles of the tutors were deliberately stated to be more like a guide and a co-learner. There were 31 students in the year 2003 and 23 students in the year 2005 who completed the course. The courses consisted of five open-ended assignments, i.e. written reports on given topics and discussion about the topics. Some of the required written reports were assigned to be made individually and some in small groups.

The main difference between the courses was that they relied on different learning platforms. In 2003, the course platform was EDUCOSM, which is designed to support collaborative learning through openly visible activity, communication and group work [9]. The EDUCOSM tool includes a document pool, comment and highlight tools, discussion boards, bookmarks and user-defined filters to view input from desired participants. There was also a separate tool for grouping, with which the student could either form a new group or join a group already formed. In 2005, the platform was widely-used groupware solution BSCW (Basic Support for Cooperative Work, www.bscw.de). During the 2005 course, discussion boards and document sharing were the tools mostly used. The grouping took place in the discussion forums and students could suggest a topic and join others groups by stating their interest.

3. Group Size

In the studied CUE-courses, the group assignments built an essential part of the courses. Tutors instructed students to form small groups of two to four members, but the group formation had to be self-organized and the activity self-conducted thereafter. In 2003, there were three group assignments and 34 groups were formed which had 2.8 members on the average. In 2003, groups had to be formed new in every assignment.

In 2005, there were four group assignments and 40 groups were formed which had 2.36 students on the average. Groups were allowed to be the same and some students did not change their group members during the course. Since groups which stayed the same during the whole course reduced the number of free movers, students were, in a way, forced to choose more the same companions from their earlier groups than in 2003.

The size of the groups varied both years from four members to tasks which were made alone (Tab. 1). On the average the groups consists of two or three members, even though the number of students was greater in 2003. Small groups are often regarded to be more flexible than larger ones, and the organization of a small group does not require as much coordination. In addition, it is easier to oversee that the members of a small group invest relatively equal amount of effort to the tasks. Depending on the task at hand, optimal group size varies but it is apparent that more members lead to greater need for dedicated roles and coordination within the group becomes more demanding [6].

The group size did not have any effect to the points that were awarded for the reports (Tab. 1). The best points were given to groups which had three members, but this is not statistically significant. For the tutors, the evaluation of a significantly larger group is more challenging than of small groups, as it is difficult to proportion the amount of work when there are more than three members in the group.

Table 1: The group size and points on the average awarded for the assignments (reports) in CUE-courses in 2003 and 2005. The points are scaled to be equal so that the maximum value is 9 points. From the year 2003 there are three group assignments and from the year 2005 four assignments.

Size of the group	Year 2003		Year 2005		Years 2003 and 2005	
	N	Points (average)	N	Points (average)	N	Points (average)
1 member	2	6.19	4	6.88	6	6.65
2 members	9	7.07	20	7.13	29	7.11
3 members	17	8.17	15	7.36	32	7.78
4 members	6	6.56	1	8.00	7	6.77

4. Number of Study Companions

Working with many study companions during collaborative courses is often seen as beneficial to the students. Groups, which have students with different levels of skills and knowhow, are more effective and innovative than homogenous groups [4]. New study companions bring also more social interactivity and ideas to the group work, even though group members' study motivations do not affect the grades in self-organizing groups [7].

In 2003, one student worked on the average with 5.5 other students in the group assignments during the course. In 2005, the number was 3.7 students, since the number of students was smaller. When the number of students is scaled to correspond to each other, it can be seen that the students worked with about one more study companion in 2003 than in 2005. This is explained by the fact that in 2005 there were groups which stayed the same during the whole course. This is also seen by the fact that in 2005 some students worked only with one or two other study companions, but in 2003 the number varied from 3 to 8 members (Tab. 2).

The number of study companions did not have any effect to the points which students got for their group work assignments (Tab. 2), as stated also in the earlier research [7]. Groups with larger number of study companions do, however, seem to achieve better grades when regarding the average of the grades (Tab. 2), but this is not statistically significant and the variation between the grades is also quite insignificant.

Table 2: The number of study companions and points on the average given for the tasks in CUE-courses in year 2003 and 2005. The points are scaled to be equal, so that the maximum value is 9 points. There are three group assignments from the years 2003 and 2005.

Number of study companions	Year 2003		Year 2005		Years 2003 and 2005	
	N	Points (average)	N	Points (average)	N	Points (average)
1			4	6.38	4	6.38
2			6	7.54	6	7.54
3	1	5.63	3	7.64	4	6.64
4	7	7.39	5	7.65	12	7.52
5	8	8.02			8	8.02
6	8	7.36	5	8.07	13	7.72
7	6	7.50			6	7.50
8	1	8.25			1	8.25

5. Selection of Group Companions

In both the CUE-courses, the students were encouraged to form new groups and choose different group members, in 2003 this was even obligatory. The grading was done by two tutors very soon after the final version of the report (student assignment) was published online, and the grades for the reports were published immediately after the grading. The points awarded to the report were equal for every group member, but because the groups changed during the course and there were also individual tasks, the total point accumulation and thus final grade varied individually.

Therefore, the students did in fact have the possibility to choose their following group companions based on the companion's success in earlier assignments. From an individual

student's perspective, a student could benefit when choosing companions performing better than him/herself. To evaluate whether students actually formed a group based on their study companions' success (i.e. points received) in the earlier assignments, we calculated the level of group companions as follows:

$$\text{Level of group companions} = \sum_{i=1}^n (x - y_i) \quad (1)$$

Where x is a position of one student among all the students after previously graded assignments; y is a group member's position after previously graded assignments; and n is the amount of group members. The closer the number is to zero, the closer the other group members are in ranking after previous assignments.

In 2003, the level of group companions varies and only a few students have chosen group companions from the same level of performance. In 2005, the situation is somewhat different and students have chosen more companions from their own level, but also groups with different level students occur. This means that groups which stayed the same whole the course, are of course at the same level during the group assignments.

Groups were thereby most likely not to be formed based on the points students received from their earlier tasks. One possibility is that the group formation was mostly affected by *friendship* formed earlier (groups which stayed the same during the course) and/or *coincidence* (groups which changed). When there is some flexibility and options in given assignments as there was both in 2003 and 2005, students with similar interests might choose the same option and a group will form "naturally". But it is worth noting that the enhanced social awareness achieved by publishing the grades for everyone could have at least an *implicit* (i.e. unconscious) *influence* on the students' and tutors' behavior [7]. Students formed the feeling with whom they would like to work with and a participant expects a certain level of performance based on their companion's earlier visible performance.

6. Group Heterogeneity

It is common knowledge that heterogeneity in academic performance among individuals is desired for group performance in higher education [5]. The group heterogeneity in CUE courses does not, however, support this.

The group heterogeneity can be calculated as an average of the group members' individual levels of group companions (Eq. 1). So first each student's individual level of group companions is calculated, of which the average of the absolute values is calculated for each group as follows (see Eq. 1 for explanations of variables):

$$\text{Group heterogeneity} = \frac{\sum_{i=1}^n |x - y_i|}{n} \quad (2)$$

The closer the score group heterogeneity is to zero, the closer the group members are in position to each other after previously graded tasks. Since the metric is calculated from the absolute values, it does not take into account the achievement level of the group among other groups. The score calculates the degree of group's internal heterogeneity, so the greater the number is, the more heterogeneous the group is.

In 2003, the average of the group heterogeneity is 16.07 and in 2005, it is 7.02. In 2005, there are more groups with zero group heterogeneity, which is due to the groups which stayed the same during the course. The group heterogeneity appears to have no effect to the points awarded for the group assignments (Fig. 1), contrary to the common knowledge.

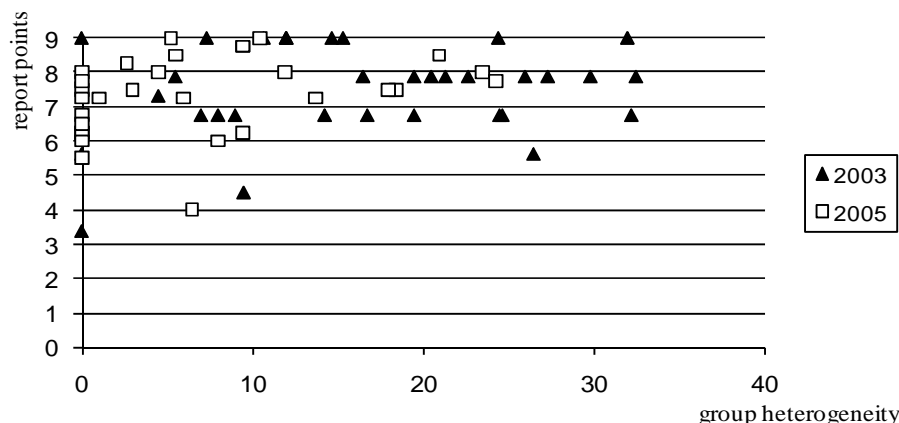


Figure 1: The group heterogeneity versus points for reports in CUE courses in 2003 and 2005. The points are scaled to be equal, so that the maximum value is 9 points. There are three group assignments in 2003 and 2005.

7. Conclusions

Two university-level courses in computer science were studied for their group dynamics. Even though the amount of students was quite small, as well the amount of groups formed, the group formation was quantitatively studied. We examined the group size, the amount of study companions and how group members choose each other, and whether these have any influence to the study outcomes.

The group size varied from one to four members, and it did not have any effect on the points awarded for the group work. Students worked on the average with four to five study companions, and the number of study companions did not either have any effect on the study outcomes. Groups' heterogeneity was also calculated to see if students choose group members by their earlier success in the courses. The heterogeneity of the groups did not have any effect on the points given for the group works, so students seem to choose group members more based on coincidence and social relations.

References

- [1] Aiken, R. M., Bessagnet, M., & Israel, J. (2005). Interaction and Collaboration Using an Intelligent Collaborative Learning Environment. *Education and Information Technologies*, Vol. 10, No. 1-2, 67-82.
- [2] Brown, R. E. (2001). The process of community-building in distance learning classes. *Journal of Asynchronous Learning Networks*, Vol. 5, No. 2, 18-35.
- [3] Daugherty, M., & Turner, J. (2003). Sociometry: An Approach for Assessing Group Dynamics in Web-Based Courses. *Interactive Learning Environments*, Vol. 11, No. 3, 263-275.
- [4] Felder, R. M., & Brent, R. (2001). FAQs. III. Groupwork in distance learning. *Chemical Engineering Education*, Vol. 35, No. 2, 102-103.
- [5] Felder, R. M., & Brent, R. (2005). Effective Strategies for Cooperative Learning, *Journal of Cooperation & Collaboration in College Teaching*, Vol. 10, No. 2, 69-75.
- [6] Johnson, D., & Johnson, R. (1983). *Learning Together and Alone*, New Jersey: Prentice Hall.
- [7] Kurhila, J., Miettinen, M., Nokelainen, P., & Tirri, H. (2003). Enhancing Groupwork with Social Navigation in Collaborative Learning Environment. *Proc. 3rd Annual Finnish/Baltic Sea Conference on Computer Science Education*, Joensuu, Finland, 15-23.
- [8] McConnell, D. (2005). Examining the dynamics of networked e-learning groups and communities. *Studies in Higher Education*, Vol. 30, No. 1, 25-42.
- [9] Miettinen, M., Kurhila, J., Nokelainen, P., Floréen P., & Tirri, H. (2003). EDUCOSM - Personalized Writable Web for Learning Communities. *Proc. ITCC 2003 Conference*, Las Vegas, USA, 37-42.
- [10] Rysjedal, K., & Wasson, B. (2005). Local and distributed interaction in a collaborative knowledge building scenario. *Proc. 2005 Conference on Computer Support For Collaborative Learning: Learning 2005: the Next 10 Years!* Taipei, Taiwan. International Society of the Learning Sciences, 534-540.