Small group learning: what are 'working' instructional ingredients?

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Abstract

For gaining mathematical knowledge, for several years, students of the Building Environment department successfully worked in small study groups. This research intended to find out which of the instructional elements of these small study-groups were acknowledged as "working instructional ingredients" (in terms of positive effects on learning) of the small study groups. Results have implications for future instructional design studies concerning small group learning.

Keywords: Student-directed learning, collaborative learning, active learning, instructional design.

1 Introduction

This study describes the experiences of the Eindhoven department of the Built Environment (see Figure 1) on delivering mathematical knowledge through learning in small groups. From of the year 2007 until 2013 we successfully used small students groups for re-sits: for those students that do not pass the traditional education with lectures. We observed that from the small groups, a large majority of the participants passes the re-sit exams. However, from the students that study in a traditionally way (that is: not in the small group setting), only a minority passes the re-sits.

Figure 1: A view of the department of the Built Environment of the Technical University of Eindhoven, the Netherlands

The goal of the present study is to identify the "working instructional ingredients" when students work in the small groups. The small group concept contrasted with our traditional (passive) approach of attending lectures. The small (student) groups were created on so called 'powerful' learning environments [1]. The main ideas of our 'powerful' small learning environments were that learning is expected to benefit from (a) the *active* engagement of students, (b) from *collaboration* among learners, and (c) from *student-directed* learning [2, 4].

2 Description of the small groups learning environment:

For creating the small learning groups, we distinguished four generic *instructional design dimensions* [3]: (1) the procedural dimension, (2) the social (collaborative) dimension, (3) the tutor and students relation, and (4) finally the assessment dimension. In using these instructional dimensions, below we describe the 17 (potential working) ingredients of the learning setting of our small groups.

2.1 The procedural dimension

For acquiring the knowledge of a mathematical subject, study-groups were formed of 7 students each.
1. The students worked during a relative *short period* of only 5 weeks, which is much shorter than the average period of 10 weeks that students were used for many other courses. Students worked intensively: during five weeks, the small study-groups had weekly meetings of about 1.5 hour.

2. The study activities of the meetings were put into a '*structured format*' in order to put students in an active role: students had to study a chapter and make assignments before the meetings. Students had to send 'study questions' to their guiding teacher (tutor) by email. Subsequently, difficulties encountered during individual self-study at home, were discussed in the small groups.

3. Prior to the start of the study groups, a plenary *starting meeting* was organized, with all participating students and several staff members. This meeting intended to explain the format of the study groups and to motivate students for studying during the course. We explained students that they had to take an active study attitude. The starting meeting also functioned as a needs assessment to clarify what students wanted and needed to learn. We hypothesized that this starting meeting was important for motivating the study-groups.

4. The study groups were presented as a *voluntary* study program, 'exclusively for motivated students'. Not every student could participate; students had to subscribe for the program and had to demonstrate their motivation.

2.2 The collaborative dimension.

The average size of our student groups was about 7 students (see Figure 2). A larger group size can lead to coordination problems and efficiency losses [5]. With 24 participating students we formed three study groups. A tutor (an older student) was added to each of the three groups. Our hypothesis was that students would
5. benefit from the hints and *explanation of the tutor*, and from

6. *explanations of peer students* [2, 8].

7. Within the study group, we tried to create the idea of *social control*: we hypothesized that student would be motivated to prepare themselves by studying at home as all other group members were intended to do so.

8. We also hypothesized that putting students together in a similar situation with a common goal could create a feeling of *social (group) cohesion* and stimulate students in their work [6].

9. An important aspect of the study groups was the voluntary choice, the idea was: either you take it all or you leave it. Either you commit yourself to all the requirements and procedures of the study program; or, if students did not respect the requirements they could be excluded from the program.

2.3 The tutor - student relation

10. Using *senior students* as tutors. The senior students that we used as a tutor were selected on two criteria: first, they had a very high grade for the course content concerned (on the average 9 on a scale of 1-10). The second important criterion was their communication skills: the tutors should be able to explain content to others in simple words. This criterion we assessed in an interview. The selected tutors were trained and they received documentation on (1) how to help students in acquiring *content* and (2) how to stimulate the *collaboration/social interaction* within the group.

11. Learning was not teacher directed (as the students were used in lectures) but directed towards students' needs: The students themselves (and not the teachers) choose the issues and problems that were discussed in the small groups. In that way we hoped that education was as effective as possible.

12. During the five week course, the tutors registered whether the students had done their work at home.

13. The tutors also registered student's attendance and participation in the study groups.

2.4 The assessment and feedback dimension

14. The course was set up in a very short and compact way; students worked only five weeks on the course content and the final course assessment was planned directly after this period. We hypothesized that this element would stimulate students in a positive way to work.

15. In the study groups, students were *very early* in the course confronted with *positive* study experiences. Already in the first meeting we guided students to successfully finish a mathematical exercise.

16. Although we helped students with their exercises, we did not provide *solutions to exercises* only *after* students had made exercises themselves. This mechanism was applied in order to stimulate students to work at home and prepare the small group meetings.

17. A *social pressure mechanism* related to assessment was that we told students that if this time they would fail for the final exam, they could not automatically do a re-sit, but had to discuss a new exam.

Figure 2: Examples of the study groups with about 7 students and one tutor

3 Method

Participants and design.

Participants were fourth and fifth year students at the Architectural faculty of Eindhoven University in the Netherlands during the academic year 2011-2012. At the end of the mathematical course under study, students filled out a survey. We analyzed only the results of students who successfully passed the final exam. From the 24 participants of the study groups, 21 passed. In addition, 20 architectural staff members also filled out the questionnaire.

The questionnaire intended to find out which of the above mentioned 17 instructional elements of the study-groups were acknowledged as 'working' (or: effective) instructional elements in terms of positive effects on learning. The question for every of the 17 instructional elements in the survey was:

Has this element contributed in a positive way to learning? Answers: *1= Not at all, 2 = Limited, 3 = To some extent, 4 = Much, 5 = Very strongly*.

4 Results

Results show that both students and staff members strongly agreed that the following seven elements of the study groups were the most crucial working ingredients (see Table 1): (1) The structured format of the study-groups (clear schedules and rules, for instance showing which exercises students had to prepare at which meeting, etc.); (2) The exchange of knowledge in a collaborative setting with peer students; (3) The coaching by the senior students (the tutors) and (4) The feedback and the explanation of these tutors; (5) Positive learning results in an early stage; (6) Education that was directed at the needs of students (student-directed learning), (7) The social relation with other students.

A second result of the survey was that students – in contrast to staff members- were *not* very positive on the learning benefits of the following six (extrinsic) elements of the study groups:
(1) The monitoring of both student's preparation and (2) the monitoring of student's attendance and group participation; (3) the starting meeting; (4) the 'threat' of exclusion for the course or (5) the threat of exclusion for a future re-sit exam, and (6) the social control of peer students. Interestingly all these elements (that students judged as

not very positive for learning), are *extrinsic* motivation measures! This result confirms previous research on learning environments that *in*trinsic measures have more impact on learning than *ex*trinsic measures [7].

Table 1: Opinions of students and staff members on 'working instructional' ingredients

Has the following instructional design element contributed to learning?	**Staff (N=20) Mean (Sd)**	**Students (N=21) Mean (Sd)**	**P-value**
Intrinsic instructional measures:			
1. Explanations and feedback of the senior (tutor) students	4,1 (0,64)	4,4 (0,64)	0,760
2. A structured 'format' of weekly study activities (e.g. weekly study assignments)?	4,5 (0,73)	4,3 (0,72)	0,208
3. Knowledge exchange with the other (peer) students	4,2 (0,56)	4,2 (0,55)	0,466
4. Positive learning experiences in a very early stage	4,2 (0,77)	4,1 (0,57)	0,941
5. Education that is directed at the needs of students (student-directed learning).	3,9 (0,99)	3,8 (0,80)	0,710
6. The social relation with peer students during the course	3,6 (0,98)	3,7 (0,82)	0,753
7. The fact that (senior) students coached students	4,0 (0,88)	3,7 (0,62)	0,180
Extrinsic instructional measures:	Mean (Sd)		
1. Social control of peer students	3,5 (0,63)	2,8 (0,80)	0,003 *)
2. Threat of exclusion for future exam re-sit	2,9 (0,86)	2,8 (1,66)	0,699
3. The 'threat' of exclusion for the course	2,9 (0,86)	2,8 (1,66)	0,699
4. Monitoring student's attendance and group participation	3,2 (0,86)	2,7 (1,11)	0,020 *)
5. The starting meeting	3,5 (0,91)	2,6 (0,86)	0,002 *)
6. Monitoring of student's preparation	3,7 (0,72)	2,4 (1,04)	0,000 *)

*) Significant difference between staff and students opinions found at .001 level

5 Discussion and conclusions

Both students and staff members agreed that critical elements of small study groups are: structure during learning, exchanging knowledge with other students, coaching from senior students, success experiences in an early stage, and student-directed learning. These results have important implications for designing future instructional environments. In using our study groups in future education we will reinforce the use of intrinsic measures, as these were found to have more impact on learning.

An explanation for the fact that many extrinsic ('external pressure') elements were less appreciated by the students may be that the group of students participated on a voluntary base and were therefore already intrinsically motivated. It may therefore be that these students do not need extrinsic elements for stimulating them.

Nowadays there is a consensus among researchers and educators that enhancing intrinsic motivation among students is beneficial [9]. Nevertheless, sometimes students are required to engage in tasks that they are not motivated to do. Thus, extrinsic motivation cannot and should not be totally abandoned [9]. More specifically, the present research showed that the tutor behavior plays a very important role in the learning process. I therefore suggest that future research might focus on the role of the tutor and the social interaction between students and tutor. Another suggestion is to repeat the model of this study in other disciplines, this might strengthen or refine certain findings.

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