Project Oriented Student Work: Group Formation and Learning

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Abstract

This paper evaluates how semi-randomly formed project groups, compared to forming groups at free will, affect students' learning in a project-oriented setting. The findings are based on empirical data. We have analyzed students' experiences by taking a course in the subject of Information Systems. The identified experiences are considered to be either a strength or a problem. We can conclude that how we form project groups has an effect on learning. We can also conclude that several of the experiences from semi-randomly formed project groups are of both a positive and negative nature. In the concluding chapter, we give some explanations in order to understand the differences in students' experiences.

Keywords: group formation, learning, information systems education

1. INTRODUCTION

This paper evaluates how semi-randomly formed project groups In this article we define semi-randomly formed groups as a combination of a student choice (forming pairs) and a randomly forming of pairs of students into project groups.affect students' learning in project-oriented work (PROW). PROW is a form of group work based on significant influences from theories on temporary organizations and student-centred education/learning (SCE) approaches. Group work and projects are one of the most common forms of SCE and are amongst the most common form of undergraduate coursework assignments (Gibbs, 1995).

A project is defined as a temporary organization with a number of project members who are interacting during a limited time in order to reach a goal (Packendorff, 1995). PROW can be understood as an approach to support learning and can also be seen as an

alternative to Problem Based Learning (PBL), (Abrandt Dahlgren & Dahlgren, 2002). Both PBL and PROW are examples of SCE approaches, which emphasize learning in context, elaboration of knowledge through social interaction, and meta-cognitive reasoning together with self-directed learning. PROW is also an example of an approach of using student groups and teamwork in higher education. It is also a fact that students spend more time working in project groups or small group discussions (Harley, 1997). This is of course, not a new phenomenon. However, the phenomenon itself is given very little attention according to Hartley (1997).

Approaches to forming project groups in higher education are considered to be a key issue in group project work (Gibbs, 1995). This inquiry tries to answer the question: How do semi-randomly formed project groups affect learning? The question is for-

mulated from a student perspective. This means that the results are based on the students understanding of learning. There are a lot of theoretical discussions about PROW but as far as we know there are no documented discussions about experiences from concrete usage. This paper is more pragmatic since we have reviewed experiences and critiques from PROW.

Besides the main question we have also asked to what extent students are positive or negative to the semi-randomly formed project groups and the overall impression of PROW.

The analysis and conclusions are based on empirical data containing students' experiences of using PROW. The aim of the inquiry is to identify occurring problems and strengths from using PROW. This study will not suggest solutions to identified problems; rather it will point out some problems and strengths experienced from usage.

2. PROJECT, LEARNING AND GROUP FORMATION

A project can be defined as "an enterprise carefully planned to achieve a particular aim" (Oxford English Dictionary, 1999). A common set of project characteristics can be listed as follows: a project is a unique task; has a predetermined date of delivery; is subject to one or several performance goals (such as resource-usage and quality); and consists of a number of complex and/or interdependent activities (Packendorff, 1995). However, in recent years the perspective on projects has changed. Several scholars use the term "Temporary Organizations" as an underlying metaphor to illustrate that a certain number of people interact during a limited time to achieve a goal (Lundin & Söderholm, 1995; (Packendorff, 1995). The traditional metaphor is that a project is a tool – a tool to reach goals at a higher level.

What we think is particularly interesting with this latter perspective on projects (from our educational arena) is that it clearly emphasizes the role of expectations, collective actions, organizing, actors' roles, relations, and learning. "The Temporary Organization" perspective also acknowledges a project as a context dependant and social phenomenon (Kreiner, 1995). This corresponds to several ideals in hermeneutics and accentuates the

significance in context, subjective and intersubjective understanding.

In the present project we consider knowledge as a construction and a self-evident part of a context (Lave & Wenger, 1991). This is a constructivist point of departure (Berger & Luckmann 1966). Every actor creates his/her knowledge and structure, and makes sense of theories, and parts of their reality in his/her own way. Our approach to learning follows Ramsden's description of the concept (Ramsden, 2003).

We focus on an approach to learning based on *how* students learn and *what* they learn; and our task as teachers is to, context-dependently, organize a conducive atmosphere for learning. Students then experience the subject matter heterogeneously and structure their own knowledge (Berger & Luckmann, 1966; Lave & Wenger, 1991; Ramsden, 2003). Minton et al (2004) have also observed the issue of learning. They are discussing the problem of diversity in relation to learning. They discuss diversity in terms of mature and traditional students and claim there are clear differences between the two groups in how they view the value of learning and their approaches to it. One conclusion in their paper is that mature students go to university to learn things, while the traditional students go to university in order to pass the exams. Clearly, these differences will affect the group work when they are mixed in a project group (see section 3).

According to Kolb (1984) ways of learning is affected by "the combination of how people perceive and how people process". People often perceive 'things' different. Therefore mixing people with different background, age, culture etc should increase the conditions for a creative group climate.

We also try to encourage a holistic and deep approach to learning – a meaning orientation (Ramsden, 2003), with a focus "on the whole in relation to the parts" and, "what the task is about". Students' analytical skills, creativity, and self-awareness are highly ranked on our agenda. It is therefore central for us to organize tasks in current courses that give students opportunities to relate new knowledge to previous knowledge, and to relate theoretical ideas to everyday experience and real life situations (ibid.).

In the project, we like to take this standpoint as a point of departure and link it to be more student oriented, take the student's prerequisites into account, and their construction of knowledge as a basis when designing education and courses. To use a project as a perspective and as a way of working can be a fruitful approach in order to create such an arena, where the student can train his/her ability to hold dialogues, interact, observe, listen to project members' perspectives, make judgments, solve problems, construct and assess their knowledge, etc. Our view of constructing knowledge, learning in context, social interaction in project groups, and assessment in PROW corresponds to core characteristics in PBL (Abrandt Dahlgren & Dahlgren, 2002).

The project is also an arena where we can create a situation that can be authentic ("genuine"; real-life scenarios), for example, to take or create, products and processes that are present in trade and industry. The situation where learning takes place is central (Lave & Wenger, 1991). In these situations it is also possible to use project management tools such as milestones, group contracts, templates and tools.

The project group is the backbone of a project. Groups in higher education are however, paid little attention when we look at the necessary skills of the students to support interaction within project groups. Some scholars even put forward the subject as: "We all use it, but still we hardly ever teach it". According to Mills (1967) a group consists of two or more people that, with a certain purpose in mind, search contact and consider this contact as meaningful.

The project groups that are formed in the present course studied are formal in the sense that they are formed to fulfil a certain purpose – to design and implement an information system (IS) in a teaching context. Every group has a set of social norms. Norms that are explicit or implicit in expectations that have an influence on each group member's behaviour. Norms can also be reciprocal; they have effects on a certain group member and group members also affect other group members.

In organizational settings, such as project work in organizations, group efficiency can be studied in three dimensions: 1) The product of the group – the result compared to defined goals, 2) The structure of the group – the pattern for inter personal relations, and 3) The process in the group – activities within a structural pattern (Davis, 1969)

Several variables influence the performance of a group. The size of the group, the goals, the formation, and the processes are a set of variables discussed by Davis (1969). The size of the group is intricate. A large group has a lot of resources (e.g. information, knowledge and experience) to fulfil its goals. Moreover, a large group requires a lot of communication and coordination. Consensus can also be hard to reach.

If we look at the goals, there should be realistic goals. The task should also be meaningful (Davis, 1969). When forming a group one should take people's capabilities, skills, and talents as well as social sensitivity into account. Processes in a group can be a part of the efficiency. Continuing reporting (feed back) concerning goal fulfilment and continuing self-assessment (e.g. of communication, decision processes, management and conflicts) are two examples.

The individual goals in a group, discussed by Davis (1969) are also discussed by Hartley (1997). Hartley proposes that we as teachers in higher education cannot take for granted that individual students will share the same feelings of loyalty and commitment to the project group.

Group work in projects is one of the most common forms of SCE (Gibbs, 1995). Groups in projects are used for a variety of reasons according to Gibbs (1995), for example, increase the amount and quality of discussion, cooperation and interaction between students; enable students to be involved on a larger-scale and in more complex tasks; produce better quality learning; develop students' team work skills; creative problem solving; oral communication skills; and to save resources. All these reasons were present in the case presented below.

As mentioned in the introduction, forming project groups is considered to be a key issue (Gibbs, 1995). Gibbs also discusses several approaches to form project groups. Formation of groups by students themselves is often based on friendship. To allocate students randomly to groups is considered to be more realistic. Gibbs (ibid.) also discusses

allocation of students to groups based on learning style testing, preferred group roles, etc. but considers the latter approach as difficult and unlikely to be effective.

The main problem with group work according to Gibbs (1995) is that it is individual students that gain qualifications, not project groups. As teachers we need to allocate marks fairly to individual students (ibid.). Simply allocating the same mark to every student in a group can lead to the problem of free-riders.

3. BRIEFLY ABOUT THE CASE

PROW was introduced and used in a university course. The subject was IS and the course was offered in the first academic year as a part of a four-year programme. This basic course takes 15 weeks, with full time studies and 60 students. The course spans from early phases in a systems development project such as a business analysis and requirement specification to system implementation of a relational database, documentation and presentation of the present solution.

An important part of the course is to deliver certain results (e.g. a data model, application increments, etc.) related to a specified project plan. In this course the students have also used descriptions and models for organizing projects, phases, documents, schedules, budgets, and risk analysis. They have reflected upon their own, and others' work and they have made comparisons. The students have also coordinated meetings and demonstrations of the developed systems.

The aim of the course is that students should learn how to design and implement an IS. Another aim in the course is to simulate real life conditions for the students to feel as if they participate in an authentic system development project. In real life there are limitations to manning a project. Employees are often busy working on other projects or other commitments. Often you have to choose project members that are available at that particular moment. In order to simulate these conditions the student groups were mainly randomly formed.

Working in a project group is the backbone of this course. The students spend a substantial amount of time working in the pro-

ject group, and taking part in other activities of the course such as lectures and seminars led by the teacher responsible.

The students were divided into ten groups and every group was formed with six members. The lecturer managed the formation of the project groups in two steps – one student formed step and one random step. First, the students chose one classmate to work together with at their own free will. In the second step, the teacher combined three student pairs into a project group by drawing lots. The conditions for forming the project groups are semi-random considering putting student pairs together into a group.

4. RESEARCH METHODOLOGY

A question that has helped us to decide upon the research methodology reads "Where does the knowledge that we are looking for exist?". Since we are interested in a student perspective on learning the knowledge exists in the students' understanding of how the learning was affected. We needed to access the students' experiences.

In order to access the students' experiences we encouraged the students to write down their experiences of PROW in an essay. These written experiences, expressed in a free format, were our data source. Using a free format means that no specific questions were asked. The reason for using an unstructured form of data collection was that we preferred to gather the students' opinions on as broad spectrum as possible Since this was the first time PROW was introduced, we wanted the students to express their experiences with an open mind. Being unprejudiced in the data collection phase is an imperative of qualitative analysis (Glaser & Strauss, 1967; Strauss & Corbin, 1998). The result of the data gathering process is a set of categories.

Having identified categories from the essays the next question was to decide upon "How should we analyze the data?" The choice of methodology fell on qualitative analysis complemented with a quantitative analysis. More specifically, the choice of qualitative analysis fell on Grounded Theory (GT) (Glaser & Strauss, 1967; Strauss & Corbin, 1998). Pettigrew (1989) claims that the methodology "provides an opportunity to examine continuous processes in context, in

order to draw out the significance of various levels of analysis and thereby reveal the multiple sources of loops of causation and connectivity so crucial to identifying and explaining patterns in the process of change".

One reason for choosing GT is that, since the students' experiences were written in a free format, it would be hard to perform a statistical analysis. Another reason for choosing GT is that it recommends the methodology user to use a paradigm model that consists of the three related concepts: condition, action/interaction and consequences (Strauss & Corbin, 1998). According to the authors of GT, the aim of this model is to support the user when explaining causality between identified categories. We decided that the character of this model is a strong argument for choosing GT since the model seems to support our need to explain how semi-randomly formed project groups affect learning.

Analyzing the essays has meant that we have searched for representative categories and related them according to the paradigm model suggested by Strauss & Corbin (1998). We have also classified every category either as a strength or as a problem.

The complementing qualitative analysis was performed in two steps. The first step embraced approximately 1/3 of the students' written experiences. In this step we were open-minded. This analysis resulted in a large number of categories; therefore we had to narrow the study. We needed to be more focused. The categories most present were "semi-randomly formed project groups" and "effects on learning". The rest of the essays (2/3) were analyzed with these two categories in focus (other aspects of the data material is found in Melin & Cronholm, 2004). Doing an analysis in this way can be seen as theoretical sampling (Glaser, 1978; Packendorff, 1995).

The result of the qualitative part can be viewed as a hypothesis. Many theories that have been developed have been tested by irrelevant hypotheses (Arthur, 1983). The generated hypothesis is grounded in empirical data. It is grounded in the student's experiences of how semi-randomly formed project groups have affected their abilities to learn. Pries-Heje (1992) claims "one of the most important strengths in GT is that building theory from data "automatically"

grounds the theory in empirical data." This implies that there is a good traceability between data, categorization and theory.

In order to reach a higher reliability and to validate the induced categories, we have also followed up the qualitative generated criteria with a qualitative analysis. Bryman (2001) claims that a qualitative strategy can be often viewed as a source for a hypothesis that can be tested further by quantitative strategies. Excluding quantitative figures is a common criticism of qualitative research methods (Gummesson, 1988).

Another aim of adding a qualitative analysis is to be able to say something about the relative importance of the categories generated. In this paper, several problems that have affected learning have been identified. To prioritize these problems in order to suggest possible solutions poses a need to identify the significance of each problem.

In the qualitative part, a questionnaire was used. The questionnaire embraced nine main statements that correspond to the categories identified from the qualitative part. We wanted the students to assess learning based on semi-randomly formed project groups; therefore we needed another group division form with which to compare the learning. Our choice fell onto forming groups at the students' free will since the students had a lot of experiences from this form. The conditions for the compared form (at students' free will) were similar to the form semi-randomly formed project groups. Conditions such as group size, course content examination forms were similar.

The statements in the questionnaire were formulated as comparisons with forming groups at the students' free will. The questionnaire also included statements about identified relationships between the categories. The questionnaire was sent to 200 students that are enrolled on the study program. 74 students answered the questionnaire. This outcome means that several students did not answer the questionnaire. We can think of two reasons: More mature students that are close to graduation don't think that the questions concern them since they are soon leaving the university. Another possible reason is a lack of interest.

5. FINDINGS

The findings are classified either as a strength that improves learning or as a problem that obstructs learning. The two main categories identified are "semi-randomly formed project groups" and "effects on learning". "Semi-randomly formed project groups" is viewed as a condition and "effects on learning" is viewed as a consequence. Both categories have been divided into sub-categories. The reason for this sub-categorization is to present a more detailed description. The findings also include a validation of the induced categories. The validation is expressed in terms of a percentage describing how many of the students that agreed with an identified problem or a strength (see table 1 and table 2).

5.1 Identified strengths

The identified sub-categories, which are classified as strengths, are "perspectives and dynamics", "motivation", "pedagogy", "social relations" and "heterogeneity" (see table 1). The sub-category "perspectives and dynamics" shows that creating a learning setting where different perspectives will meet and that the setting works as a place for group dynamics led to a developed understanding of different perspectives on IS development. 87 percent of the students agreed about that semi-randomly formed groups increase the possibilities to discuss different perspectives and 94 percent agreed about that an increased group dynamic implies a higher developed understanding about different perspectives.

Based on the answers above we can conclude that a significant number of the students thinks that the possibilities to discuss different perspectives and understanding increases when forming groups semi-randomly. The findings concerning group dynamics can we relate to Gibbs (1995) assertions, in which approaches to forming project groups are a key issue in project work, and affect learning.

The next sub-category "motivation" means that the students have understood the group formation as fun and authentic. The normal case in real life is that project members can't choose who they like to work with. Project groups are often formed according to competence or employees that are available for the moment. Trying to simulate the conditions that exist in real life has increased the motivation for the course. The students'

experienced that they are better prepared for working life. 67 percent agreed that the project group-work became more fun with semi-randomly formed project groups. 79 percent agreed that the project work became more authentic. Our findings are in line with Ramsden (2003). Ramsden (2003) also highlights the significance in relating theoretical ideas to everyday experience and real life situations for students in higher education.

The sub-category "pedagogy" means that semi-randomly formed projects groups are a way to consciously plan for a group climate that increases the possibilities for consisting of students with different ways of thinking. Since different opinions were debated, this way of forming groups was conflict-generative. The students felt that learning was stimulated when they had to work together with students that had different opinions. 85 percent thought that a semi-randomly formed project group implies that more conflicting opinions occur. When we asked if more conflicting opinions stimulated learning, 62 percent of the students agreed. Davis (1969) describes that consensus can be hard to reach in groups. To reach consensus does not have to be a goal in itself, because the lack of consensus can stimulate learning.

The sub-category "social relations" means that semi-randomly formed project groups provided an opportunity to meet new people. This opportunity has improved skills such as conflict management, ability to understand other people's needs, communication capability and the ability to collaborate. 92 % of the students agreed about this statement. The qualitative data also indicates that the opportunities in meeting new people and improved social skills were dominants strengths. If we relate these findings to theory, Gibbs (1995) claims that groups in projects are used for a variety of reasons, to for example: increase the amount and quality of discussion, cooperation and interaction between students; produce better quality learning; and develop students' team work skills, and oral communication skills.

Table 1. Identified strengths

Sub-cate-gory	Condition: Semi-randomly formed pro-ject groups	Conse-quence: Effects on learning
Perspectives and dynam-ics	Possibilities for discussing different perspectives Group dynamics	Developed understanding of different perspectives
Motiva-tion	Authentic Fun	Prepared students for working life
Peda-gogy	Conflict gen-erative	Stimulated learning
Social rela-tions	Opportunities in meeting new people	Improved social skills
Hetero-geneity	Different pre-knowledge and motiva-tion	Students with lower learning ca-pability have learned from students with a higher capability

The final sub-category "heterogeneity" means that mixing students with different pre-knowledge and motivation has resulted in students with a lower learning capability learning from more able ones. A dominant share of the students (85 percent) agreed about "semi -randomly formed project groups imply that students with lower pre-knowledge can learn from students with higher pre-knowledge". The latter observation can be seen as positive and negative, positive in the sense that students interact socially in groups (cf. PBL above), construct knowledge and help each other to learn (Hartley, 1997). This observation also supports the fact that teachers in higher education cannot take for granted that all students will share the same commitment or loyalty to the project group (Hartley, 1997). This is part of the negative side concerning differ-

ences in knowledge and motivation that is further described below as free riding.

Identified problems

We have also identified a number of problems experienced (see Table 2). The identified sub-categories classified as problems are "coordination", "heterogeneity", "motivation" and "social relations".

The first sub-category "coordination" has to do with the practical organization of PROW. Another way of forming student groups is to let the students themselves form the groups. Often this way of forming groups results in students that have the same gender, age, interest and living in the same area are joining the same group.

An identified problem when creating project groups semi-randomly is that there are different wishes about working times, there are conflicting activities outside the university and a geographical distance between the project members. Different wishes about working times could be that some students have a family and therefore had problems with late working times. Another difference is that in our university some students live on campus whereas others live in their own homes both in the city and in other cities. This means that some students have a larger geographical distance to the university and therefore prefer to work with students that live in the same area. These different preferences have obstructed learning and have lead to group conflicts and a non-creative group climate.

82 percent of the students claimed that semi-randomly formed project groups could imply that project members have different wishes about working hours and 78 percent agreed about different wishes about working places. As a consequence, 81 percent of the students agreed that project groups have coordination problems due to working hours and working places and that this fact implies an increased risk of group conflicts and re-duced learning. It is clear that different wishes about working times, conflicting activities outside the university and geographical distance between project members, obstructed learning due to group conflicts and non-creative group climate. The aspect of coordinating project group-work in time and space is not exhaustively investigated in the literature. Our findings show that this aspect

of coordination is important to address when forming and handling project groups in higher education.

The sub-category "heterogeneity" is identified both as a strength and as a problem. The students had different knowledge levels, study techniques, ways of thinking and study experiences. This heterogeneity obstructed the learning. The students with a higher ability worried about becoming invisible in the group, not being able to fulfil their potential and not being credited for their efforts.

On the other hand, it was hard for students with lesser ability to keep up with the working pace of students with higher ability. These differences have led to a non-creative group climate and non-effective learning for both students with higher ability and for those with lower ability. Too many ways of thinking and too many opinions have also resulted in delays in reaching an agreement.

86 percent of the students agreed about "Semi-randomly formed project groups imply that differences according to pre-knowledge, techniques of study, ways of thinking and the study experience are higher among the project members". 45 percent of the students didn't agree upon the statement: "semi-randomly formed project groups imply that students with a higher capacity have more difficulties in fulfilling their potential and that they will not be credited for their efforts". At the same time 48 percent of the students agreed that this was the fact. The ineffective dimension of learning identified in the qualitative data material is not that evident in the quantitative data material. When analyzing this statement we have found that the quantitative data material produces a more nuanced picture of the relation between the formation of groups and the differences in students pre-knowledge and efforts. The relation was identified as unambiguous in the qualitative analysis, but was revealed as more complex and divergent in the quantitative analysis. The main problem with group work (Gibbs, 1995) is that it is individual students that gain qualifications, not project groups. And as teachers we need to allocate marks fairly to individual students (ibid.). The quantitative data shows a divergent picture if teachers succeeded in marking or not.

As part of the analysis of heterogeneity we also investigated the statement: "Semi-randomly formed project groups imply that students with a lower capacity have more difficulties in keeping up with the working pace". 72 percent of the students agreed that this was the case. 63 percent of the students agreed that these differences increase the risk of group conflicts and reduced learning. This pattern is not identified in the qualitative data material. The literature that we have reviewed gives no or little support. According to Davis (1969) one should, when forming a group take people's capabilities, skills, and talents into account. But Davis (1969) gives no guidance as to whether one should take heterogeneity or homogeneity as dividing criteria when forming groups. In order to further analyze these aspects of heterogeneity we need more information. This is further discussed below in future research (see section 6).

There were also differences in motivation. The students had different levels of ambition, commitments to the task and to the goal in the course. Some students aimed at lower grades and some students aimed at higher grades. This heterogeneity obstructed the students' learning. The different levels of ambition also lead to anxiety concerning grading and an anxiety about so-called free-riders.

96 percent of the students fully agreed about "Semi-randomly formed project groups imply that differences in levels of ambition are higher among the project members". When forming groups semi-randomly the students confirm that there are higher differences between the project members in the commitment of the present task and goals. 88 percent of the students agreed that this was the case. These differences increase the risk of group conflicts and reduced learning according the students. The next statement "Semi-randomly formed project groups increase the risk of the existence of free-riders" resulted in an agreement of 65.

Table 2. Identified problems

Sub-Category	Condition: Semi-randomly formed project groups	Consequence: Effects on learning
Coordination	Different wishes about working times Conflicting activities outside the university Geographical distance between project members	Obstructed learning due to: Group conflicts Non-creative group climate
Heterogeneity	Different pre-knowledge: Knowledge levels Techniques of study Ways of thinking Study experience	Obstructed learning: Group conflicts Non-creative group climate Ineffective learning
Motivation	Heterogeneity such as differences in: Levels of ambition Commitment to the present task and goals	Obstructed learning to: Group conflicts Non-creative group climate Ineffective learning
Social relations	Different personal chemistry	Obstructed learning due to: Group conflicts Non-creative group climate Ineffective learning

It is obvious that there is a risk in forming project groups semi-randomly. Differences in level of ambition and commitment to the tasks and goals are two important risk factors to consider. However, the free-rider syndrome doesn't seem to be a risk factor of that importance. Gibbs (1995) claims that allocating the same mark to every student in a group can lead to the problem of free-riders. However, this statement doesn't take the problem of group formation into account when discussing marking and the free-rider syndrome. These observations also support that teachers in higher education cannot take for granted that all students would share the same commitment or loyalty to the project group (Hartley, 1997).

The last problem "social relations" also occurs among the strengths. When the students form groups by themselves they often choose classmates that they feel comfortable with. Forming project groups semi-randomly means that students with different personal chemistry have to work together. In some project groups this led to group conflicts that obstructed learning. The statement "Semi-randomly formed project groups imply a higher risk that students with different personal chemistry have to work together" resulted in 79 percent agreement. 84 % percent of the students also agreed upon the statement that the differences in personal chemistry can obstruct learning. Social sensitivity is considered to be an important aspect when forming groups (Davis, 1969). We agree with Davis concerning the importance of social sensitivity as a student skill to be achieved. We are also interested in how to achieve this skill. Unfortunately Davis' findings do not give us that kind of advice.

6. CONCLUSION

The contribution of this paper is to present students' experiences from semi-randomly formed project groups and how this way of group formation affects learning. First, it is clear that this way of forming groups affects learning (see Section 5.1). This means that there is a relationship between how groups are formed and learning. We have described this relationship as a casual relationship in terms of conditions (group formation) and consequences (learning).

The aim of the qualitative part is to generate a hypothesis that is grounded in empirical data (i.e. the students' experiences of how semi-randomly formed project groups affect learning). The hypothesis consists of several categories that are divided into strengths and problems.

One interesting observation is that several of the identified sub-categories exist in both the table of strengths and in the table of problems. One explanation for this observation is that it appears that some of the students prefer a more secure and safe study situation. They prefer to work with students they know well in order to reach the course goal with as little disturbance as possible. Their attitude towards effectiveness (e.g. optimizing time and effort in order to reach a goal) in learning situations is an important condition.

Another way to interpret this observation is that there is an anxiety among these students about change. They feel comfortable within a group that has well-developed routines and social relations. In our data material we have also found that there is an anxiety about grading. Forming project groups semi-randomly means that students with varying motivation had to work together thereby causing anxiety about whether this way of forming groups could have a negative impact on grading. These students have an anxiety about so called free-riders. Breaking up groups that work well will probably generate negative attitudes when forming project groups semi-randomly. These students view semi-randomly formed groups as a hindrance to learning.

On the other hand, there are students that look forward to meeting new project group members. One explanation is that they perceive semi-randomly formed groups as an opportunity to achieve an improved group dynamic since different opinions and perspectives will be debated. They prefer such conditions since they increase the possibilities for improved learning. Another explanation is that there are students that do not feel comfortable in their current project groups and therefore welcome a change. The reason for the discomfort is that there were problems with the social relations within the group. The observation that several of the sub-categories are viewed both as a strength and as a problem can be summed up by inferring that there is a tension between the new (the exciting) and the old (the secure).

The aim of the quantitative part is to test the hypothesis generated in the qualitative part in order to achieve more reliable results. As presented in Section 5.2 the results achieved in the qualitative part have in general, a high correlation to the results achieved in the quantitative part. The results from the quantitative part have moreover contributed with refined and nuanced knowledge concerning several categories.

The main contribution from this part of the study is that the students' experiences are more divergent than the qualitative part showed. Furthermore, the results from the qualitative part have strengthened the importance of the categories generated in the qualitative part and contributed with nuanced knowledge about the categories.

The main conclusion when forming project groups is that it should be a reflected choice and the categories generated in this study (perspectives and dynamic, motivation, pedagogy, social relations, heterogeneity and coordination) should be considered. Of course, every course design situation is context-dependent; which means that some of the categories can be more relevant than others in different contexts. Finally, we claim that the results from this study should also be valid for other types of SCE approaches where project group-work is an important part, such as in PBL.

As future research we propose three main directions. The first direction is to broaden the unit of analysis. The aim of this direction is to improve the ability to generalize the results. In order to make a generalization the researcher should search for variation. Therefore, we propose a complementary study where data is gathered from other types of courses and from more advanced courses.

The second direction that we propose is to compare the results from this study to studies that have used other ways to form project groups; either by students forming groups by themselves or completely randomly. In this study we have identified strengths and problems from semi-randomly formed project groups. Our aim has not

been to propose solutions to the identified problems. A third future direction could be to suggest and evaluate possible solutions to the identified problems.

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