

# “I Think It’s Better if Those Who Know the Area Decide About It”

## A Pilot Study Concerning Power in CS Student Project Groups

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### ABSTRACT

In the light of an emerging interest in project work within the CS curricula, research about projects is gaining importance. In the current work I investigate a full semester CS project course, where focus is on how power is distributed within a group of students. CS skills are shown to be a contributing factor when it comes to power. Using a phenomenographic research approach, a way of researching some aspects on power within CS projects groups is demonstrated. Finally, three qualitatively different ways of experiencing CS skills of other students, and thus power, are revealed.

### 1. INTRODUCTION

In this work I examine a method to study students’ understanding of CS skills, later on referred to as perceived competence, and the relationship between perceived competence and power within student project groups in CS. This pilot study focuses in particular on the role of perceived competence as a power base. In the light of the emerging research on collaborative student projects in higher education in CS, for example Barker [1] and Berglund [3], extended knowledge about social skills and their interactions are shown to be desirable. This is especially true when one of the motivations for doing projects within the CS curriculum is the linking of social and technical skills. The collaborative teaching form also offers a deeper understanding of the context in where the technology is supposed to be implemented [11].

Open Ended Group Projects (OEGP) [10], like the one explored in this study, are becoming increasingly popular. They offer a learning environment where social components are important. Authority, roles and hierarchy all have an influence on the learning process [2]. Therefore, it is important and relevant to question the role and impact of power in these student projects. This study does not just take a step in the direction of knowledge about power interaction within student projects, but also develops a method for doing such research.

OEGP has a component of social interaction [10] where the current research project has a contribution to make. The literature within the field of CS education research consists of only a few studies remotely close to this subject (see for example Barker [1] and Berglund [3] for a note-worthy exception) which also stresses the need for further research.

The point of departure in the current study is a full semester project course for final year IT engineering students in collaborative project work, aiming at designing and implementing an advanced robotic system. The technical level of the resulting

robotic system is specified in advance, but the design of the final system depends on the students’ own choices.

### 1.1 Research Questions

The main research question of this pilot study is how the students become aware of competence of other students in the CS project group. To put it more precise, *what makes CS students experience fellow students as being competent within the subject area?* Thus, the phenomenon investigated is the manner in which CS students experience their fellow students as competent. This question is to be seen as an initial probe for the feasibility and relevance of research in the more general area of power within student project groups.

### 2. RELATED WORK

#### 2.1 Definitions of Power

A classic definition of power, which is the one used in the reported study, is that of Dahl: “A has power over B to the extent that he can get B to do something that B would not otherwise do.” (p. 203) [7]. Moreover, Provan [16] argues that power can be divided in potential and enacted power. Potential power, on one hand, is for instance based on position, formal authority and membership in groups having control over key decisions. On the other hand, enacted power is the “demonstrated ability to affect organizational outcomes” (p. 7). This means that Provan makes a distinction between shown, or demonstrated, power and power that comes with a position in a certain place.

Furthermore, power can have many faces. French & Raven identify five different forms of power; coercive power (the power to force someone to do something), reward power (the ability to ask people to do things in exchange for something they want), legitimate power (power connected to a role), referent power (the power given by someone who adores you and wants to be like you) and finally, expert power (when someone has knowledge and skills that someone else requires) [17].

#### 2.2 Project Work Among Students

The issue of project work as an educational setting in engineering and CS has been investigated in several papers, for instance Brown and Dobbie [4], Coppit and Haddox-Schatz [6], Newman et al. [15] and Leeper [13].

Seat and Lord [18] emphasize the importance of practicing interpersonal skills like communication and teaming. They refer a program for teaching interaction skills to engineers with the aim of increasing the efficiency of their technical skills. The approach for teaching those soft skills was to let the students adopt a simple set of general principles and apply them to their own

<sup>0</sup>The title is a citation from the interviews by Lukas.

context. From there, the students could play and interact in supervised groups with the possibility of getting feedback.

The students' motives for learning within a project environment are elucidated by Berglund [3] where the social dimension, academic achievement and project skills are identified. Berglund has investigated and reported on the control structure of CS teams in a very similar social context to the current study. Tensions or contradictions in the groups have also been identified and exposed as a part of the social game within the group.

Barker [1] sheds light on how unclear aims in projects have a negative influence on the learning environment and pedagogic outcome of the project model. Even though performed in another social context, Barker presents findings worth considering. One of the more noticeable results from that study is the unawareness of the effects of knowledge asymmetry, which happens when one group member is more skilled in a topic than the others are. Knowledge asymmetry can be used for peer tutoring, a beneficial situation for both parties. But, when students select their own roles in the group, they often tend to choose task where they already are more skilled in and by that lose the major impact of the peer tutoring in collaborative work. This also implies that in a group allocating tasks themselves, improved learning does not automatically follow. Barker also argues that only when group processes are made explicit, can activities lead to enhanced learning.

### 3. PHENOMENOGRAPHY

In order to explore the complex question of why somebody has a stronger position in the CS project group, I take a phenomenographic approach. Phenomenography is a research framework for revealing the qualitatively different ways in which people experience a phenomenon. The approach is a second order research perspective that tells something about other peoples' experience of the world. The opposite, a first order research perspective, makes statements about the world [14]. Thus, in order to learn about how students experience competence of others, phenomenography is an appropriate approach.

A phenomenon can be experienced in many different ways. The rationale behind phenomenography is to find and describe the outcome space which consists of the different ways of experiencing the particular phenomenon [14]. An important characteristic of a valid phenomenographic outcome space is the relationships between the categories. Cope [5] describes this:

“One of the consistent findings of phenomenographic studies is that a group of individuals will experience the same phenomenon in a limited number of distinctly different ways. Importantly the different experiences have been found to be related hierarchically based on logical inclusiveness and increased level of understanding.” (p. 68) [5]

The concept of awareness of a phenomenon can be understood as its meaning and its parts and their relationship [14]. Together these two aspects create a whole. Berglund [3] has an example of this:

“A coin of one euro can serve as an illustration: To get a full picture of such a coin, both the meaning (a currency in many European countries; that is, a legal tender) and its shape (round, consisting of two different metals) must be known.” (p. 40-41) [3]

## 4. THE STUDY

The empirical data was collected from a CS project course in the final year of the IT engineering program at the Department of Information Technology, Uppsala University. The course duration is one semester. The students together carry out a task of designing and building a power line inspection robot [9]. The project course usually involves two 12 person teams with support of 2-4 teachers. An earlier instance of this course is described in Daniels and Asplund [8].

The student cohort was analyzed by study background, stated interests and project roles. From that analyze, eight students representing a great variety concerning those variables were selected. Those eight students were then interviewed. The interviews were transcribed verbatim. An iterative process of identifying and categorizing the experiences followed, where sorting and resorting piles of excerpts was a major activity. Finally, an unambiguous distribution of excerpts in categories where found and thus the iteration ended.

## 5. EMPIRICAL RESULTS

The study shows two results. Firstly, perceived competence, presumed or demonstrated, leads to increased influence. Secondly, three different ways of experiencing competence can be found in the project group: presumed skills, earlier demonstrated skills and demonstrated skills.

### 5.1 Perceived Competence as Contribution to Influence

All interviews conducted indicates that perceived competence is a contributing factor when it comes to influence within the student project. One typical example is the excerpt from Emil<sup>1</sup>.

**Interviewer:** Are there some [students] whose opinions get more attention?  
**Emil:** Yes, those who have competence. It feels like William and Lukas have most.  
**Interviewer:** And people listen to him?  
**Emil:** Yes.

This result is expected and in line with French & Raven's discussion about expert power and increased influence; by expressing yourself as competent you increase your influence.

### 5.2 Experiencing Competence

Three qualitatively different ways of experiencing competence of fellow students within the current student project have been identified. These three categories constitute the phenomenographic outcome space. Since the three presented categories build on each other and each of them contributes with a qualitatively difference, they are connected.

#### 5.2.1 Category One: Presumed Skills

This category holds expressions that support a presumption of competence. The expressed thoughts about someone's competence are not founded upon any evidence thereof, but rather on presumptions. The following excerpt from Emil illustrates the category.

**Interviewer:** And what is it that makes people listen to them?  
**Emil:** That they seem to know what they talk about.

<sup>1</sup>To preserve the anonymity of the students, their names in all excerpts are replaced by fake ones.

Another student, William, emphasizes this when he talks about how he was appointed a certain task.

**Interviewer:** Why do you think Oskar appointed you?  
**William:** Because he thought I knew what I was talking about.

### 5.2.2 Category Two: Earlier Demonstrated Skills

This category holds expressions of skills demonstrated in earlier settings. Experiences of someone's abilities to solve problems, not within but close, to the current project focus are articulated. Thus, presumptions about someone as competent are based on evidence, but not from the same area as the project deals with. Again Emil helps us with an example of this category.

**Interviewer:** Then competence is something one takes into account?  
**Emil:** Yes, I definitely think so. It's not like one puts someone that doesn't, sort of isn't used to, having responsibility for a server to have it. One rather takes someone that has it, already have responsibility and experience from before.

### 5.2.3 Category Three: Demonstrated Skills

This category describes that someone's acting during the current project work constitutes the bases for fellow student's interpretation of the competence of him/her. Showed skills within the present project are interpreted as evidence of competence. The category implies that the subject is presumed to be competent, but now with evidence from the current project. The difference is that the evidence for the presumed competence is from the project setting where the competence is needed. Let us hear how Erik explains the core feature of this category.

**Interviewer:** Did he get responsibility at the start, [...] To decide this much?  
**Erik:** I don't think he decided all that much in the beginning, it sort of grew. He has proved himself competent several times. And the more he come through as competent, that he made the right decisions, the more we others allowed him.

## 5.3 Discussion

The initial result that perceived competence contributes to influence in student projects in CS is emphasized in all of the interviews performed. This is therefore the starting point for the data driven phenomenographic analysis that leads to the second result.

The result concerning how students experience the competence of their fellow students is summarized in table 1. The table differentiates between the meaning of the categories and the relationship between them.

Focusing on the differences, the inclusiveness between the categories can be elaborated. The first category and the second category have its main difference in the expressions of skills in earlier CS projects.

Let us listen to a continuation of the last excerpt from category one, where William gives an example of the inclusiveness and the difference.

**Interviewer:** Why do you think Oskar appointed you?  
**William:** Because he thought I knew what I was talking

about.  
**Interviewer:** There was thus a presumption...  
**William:** Yes, we have also worked together before.  
**Interviewer:** You know each other?  
**William:** Yes, everyone in the project has more or less worked together before except Lukas and Alexander.

In the next category, demonstrated skills, the qualitative difference is that the demonstrated skills are from within the current project. However, still the experience of competence is based on evidence from earlier projects and then increased with experiences of skill from the current one. Emil, who first expresses an earlier demonstrated competence and later also states experiences from the current setting as indications for competence, describes the differences for us.

**Interviewer:** Did he come in with this responsibility [...] What made you presume, to understand, to know, that Lukas mastered it?  
**Emil:** At the start it was just because he studied at the Electronic engineering study programme. And the... it has become clear that he is very competent. That he does good things.

Thus, the categories are getting more and more detailed with respect to their requirements about skills relevant to the current project.

## 6. CONCLUSION

Two important conclusions can be drawn from the study. First, perceived competence contributes to personal influence in the student project groups. Second, three qualitatively different ways of experiencing competence among other students have been identified.

The first result about perceived competence has obvious similarities with results from other studies regarding the value of competence. For instance Grant et al. [12] concludes in an article regarding the importance of technical competence to project managers that: "A majority of respondents in the sample, regardless of personal or situational factors indicated technical competence is extremely important or absolutely essential" (p. 17). Barker and Garvin-Doxas [2] emphasize that status is something you earn in the classroom by giving evidence of skills: "status is informally accorded to those who display their ability to write 'elegant programs', display ability to reason well [...] or provide other needed information" (p. 16).

How well these different studies are comparable with the current study is of course an issue for discussion. Being studies of another context (the defence acquisition) or other settings (classrooms), they still could support the current finding.

The second result is in accordance with the work about potential and enacted power of Provan [16], someone's possibility to control project decisions is based on competence and not formal positions. Thus, competence as a source for power in the current study can be identified as leading to enacted power.

### 6.1 Open Questions

There is an emerging focus on team work in the CS curriculum. Despite this, the research that is performed on human power and the effects of power on the learning outcome in students' teams in CS are still limited. With respect to those circumstances and

| Category | Meaning                     | Characteristics  |
|----------|-----------------------------|--|
| One      | Presumed skills             | Expressions that support a presumption of competence.  |
| Two      | Earlier demonstrated skills | Expressions of abilities to solve problems not within, but close to, the current project. Presumptions about someone as competent are based on evidence, but not from the same area as the project deals with.   |
| Three    | Demonstrated skills         | Someone's actions during the current project work constitute the basis for fellow student's perception of his/her competence. Gradually shown skills within the particular field of application are interpreted as evidence of competence. The category implies that the student is presumed to be competent, but now with evidence. |

**Table 1: Categories of description of what makes CS students experience fellow students as being competent within the subject area.**

the indications derived from the current study that power is an influencing factor, the following initial research questions are proposed for further research;

- in what ways are influence and responsibility as well as the organization of the teams related to the learning outcome,
- are there other ways of distributing influence than perceived competence,
- is the distribution of influence in the teams related to the students' perceived competencies of CS, and
- what can be learned about influence and responsibility in order to prepare rewarding project settings?

The presented work also opens up for several relevant methodological and legitimacy questions connected to my Ph.D. work, where I am especially interested in;

- how well phenomenography can be used for investigating influence, and
- how power and social interaction research has its application within CSED?

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