

Conclusion

In this paper we have tried to show the start of our work on analysing and describing the context of learning as experienced in a particular complex course of computer science, where groups in two countries form software production teams. Phenomena in the learning context are experienced in qualitatively different ways by the students, and in this paper we have focused specifically on the experience of the grading systems employed. By analytically associating the various ways of experiencing a particular phenomenon in the course context to the nodes in an activity system, we plan to elaborate our understanding of how the learning situation as a whole is experienced, with contextual phenomena constituting a whole in a dynamic process. Attempts to make such an association can, as in the examples presented here, indicate that the distinct ways of experiencing particular phenomenon can be associated with different nodes, and that relations and conflicts between them can be analysed to give a more complete understanding of the learning situation.

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presentation. The theme of a community, being in a group, or of your own group in front of other groups, is important. The group is what makes it possible to reach the objective.

Thirdly, we associate the third category ("Grading as an obstacle") to the rules node, since here the grades are experienced as something that is imposed on the students, and which regulate their work to the detriment of the software system development. These regulations, or rules, form an obstacle to the work of the group.

With this mapping of the qualitatively different ways of experiencing grading on an activity system, we can turn our attention to possible relationships and conflicts within the activity system as context for learning. This is highly preliminary, and needs to be extended when other features of the context have been analysed in a similar way. But even now we can begin to see potential conflicts connected with learning and grading.

The issues of the prioritising between different parallel courses are discussed by students who describe the grading as important for themselves as individuals (Category 1). This is a concern about how to distribute time and work between different courses. A conflict can be identified between this course and other courses taken by the same student. This line of reasoning should be further investigated, not only in the light of the students' experience of one course, as is made in this paper, but in the light of experience of an activity with a larger perspective.

Concerns of the two different grading systems are voiced in this category that indicates a possible "we"-and-"them" discussion, raising the question of the experience of the group that work together, and the understanding of the community. The relationship between the group of three students in one country, or the group understood as enlarged to comprise the whole international group is also an issue for future research.

In category 2, the importance of other mechanisms than grades, particularly the group, is brought up. The grading is also experienced as a feedback system in this category, indicating the progress and the direction of the group. This understanding of the grades can be related to the node of tools, since it the grades are experienced as a resource that helps the group of obtaining their objectives, or, in other words, as a tool that mediates between the subject and the object.

In category 3, a conflict can be identified between the grading system, experienced as an obstacle, and the object the work of the group. This is clearly voiced by Axel, as quoted earlier, who argues that the attention of the group members is split between working for the project and working for a good grade.

The concerns held by the staff during the design and organisation of the Runestone course, about the risk of conflict caused by the grading system, cannot be directly confirmed by this study. No student has stated that the group members in the other country, who are assessed in a different way, work less, or are less dedicated than he or she is. These findings correspond well to the results of Pears et al (2001), who have analysed the self evaluation and peer evaluation of the students in the Runestone project with statistical methods, and found that the Swedish and the US halves of teams agreed on the origin of contributions, irrespective of physical location, and that there were no important differences in the students' estimation of the contribution in the two countries. It can be noted though, that some students vaguely report on difficulties due to the grading systems in groups other than their own. At the current state of this research project, it is too early to say, whether these statements are projections of their own opinions on other groups, or if there are other reason for these statements, and the potential for the feared conflict needs to be studied indirectly through further analysis of the activity system.

Discussion

We have discerned three qualitatively different ways of experiencing the grading in this distributed group-based project with two different grading systems in use, summarised in table 1 earlier. Of these three, two are apparently opposing in a sense: the grading could be understood as a goal in itself (category 1) or as an obstacle for the work of group (category 3), either spurring the group on or drawing them back. Somewhere between these, the grading can be experienced as less important than other features in the course (category 2), a rather neutral position.

In order to begin to put the ways of experiencing aspects of the learning context into relation to one another, and to begin to see a whole picture of the learning situation for the students in the course, we have related the categories thus described to an activity system. We are, however, aware that care must be taken when making these associations and analyses. The different nodes in activity systems, as well as the categories we have discerned, are analytical tools constituted by and for researchers. Nodes in the activity system correspond neither to physical entities nor directly to experiences or understandings. Furthermore, since the activity is defined and motivated by the object towards which the work is oriented, an analysis of the object is fundamental. With these restrictions in mind, it can be rewarding to tentatively associate the different ways of experiencing grades to the nodes in an activity system. Such an association is presented in Figure 1.

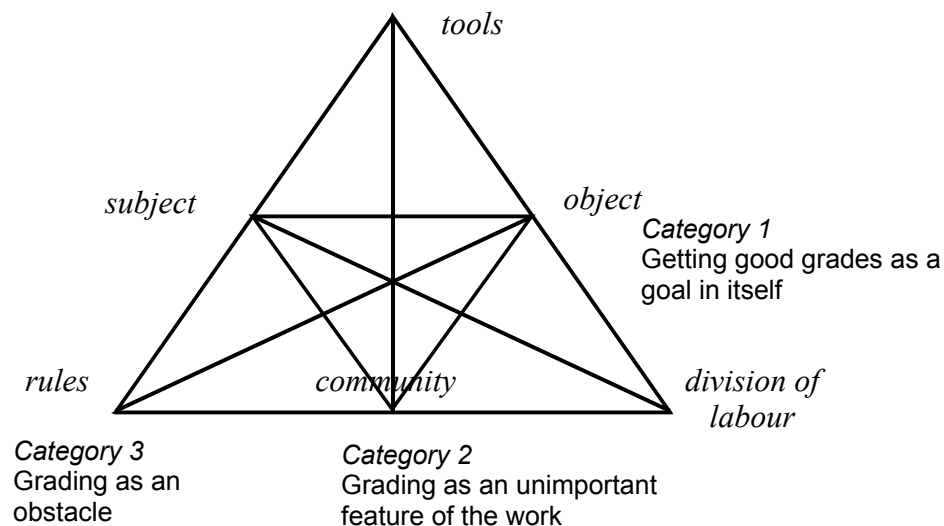


Figure 1. The three ways of experiencing grading related to an activity system, seen as the context of the learning situation

Category 1 ("Getting good grades as a goal in itself") we find related to the object node, described by Engeström (1993) as "the problem space at which the activity is directed" (p. 67), which is clearly the case for grades experienced as a goal in themselves. The grades are experienced as part of the overall goal of the course, apparently as important as producing a functioning software control system. Attention is directed towards them in the activity of producing a software system.

In the second category ("Grading as an unimportant feature of the work"), we relate to the node of community. The role of a group, or a community, is referred to in two ways within this ways of experiencing grades: as a group member, you should do well in your group, and the project group ought to do well, not to feel ashamed in front of the other groups at the

time, so we can get a better grade. And I hadn't even thought of that, that that was why they wanted feedback, 'cause you want feedback to check you're on the right track, not for the sake of the grades but more that... But that's the difference

Here two ways of seeing grading as a feedback system are being contrasted, one that supports the constitution of the current category – feedback is for checking the work and grades are of less significance – and one that supports category 1, as a measure of potential grade, as a goal in itself.

In this category, we have met a description of grades, as not being an important factor for promoting the work of the individual or the group. Other mechanisms have been put forward as stronger: the group as such, pride in the work of the group, wanting to present good work. Grading can have another role than being a goal in itself, as in the previous category, namely as a feedback instrument.

Category 3. Grading as an obstacle

Grading is described as a feature that may act as an obstacle to the work in the group in this category. The sense of imposing such a system is brought into question, and the attention that is given to grades can detract from the attention to the project itself.

That a detailed, individual grade may create problems is illustrated by what Samuel says in the first interview:

Samuel₁: All that, I don't know, I don't know if it has a place in such a course, in any case I don't think it is right for such a course, not at all, I can understand that you can have grades like that in a written exam, that's OK, I can understand that, 'cause there you can judge the knowledge. But in a project like this where several people are involved, I don't think it should be competitive like that at all.

Interviewer: Might it be some sort of problem for you?

Samuel₁: Yeh sure, sure, it can, well, the ones who are best in the group, well, they might not be happy with the grade that the whole group gets, they might think that they would be better off by themselves than in the group, of course, that would be a problem, I don't know, but it must...

This implies that a system that encourages competition between group members, can create problems within the groups. Later during the interview (not cited in this paper), Samuel says that he has not seen this kind of problems in his group.

Detailed grading is also referred to as detrimental here, at the end of the first interview:

Interviewer: Anything else you want to say about the group or the project?

Axel₁: [...] but I feel kind of handicapped on this project by the fact that we're getting a grade because it um, the requirements for each report have been a little bit unclear. [...]. And so we're spending a lot more time than is really useful getting together reports and making sure that we've got all the stuff that we need to get a good grade, instead of working to, to make sure that we do the project and get it up and running.

Detailed grade is felt to be a handicap since it encourages the students to work in a way that promotes the grading, but that distracts attention from the project itself.

Interviewer: There are different grading systems in the two different countries.

Adam₁: Uhuh

Interviewer: Does this affect...?

Adam₁: Well, um, it was a concern at the beginning, because our impression was that this is a letter grade for us and a pass/fail kind of thing for them and we were concerned that maybe they won't take it seriously because it wasn't going to affect their grade as much. But that is something that, um, when we actually started doing work and stuff like that, they certainly are not, um, just trying to get away with the minimum, or holding back in any way. They seem to be just as dedicated to it, as we are.

Thus his initial worry, that the Swedes with their pass/fail system would not take the project seriously, and that thus even his grades would suffer, was found to be ungrounded.

Category 2. Grading as an unimportant feature of the work

This category refers to an understanding where the grades are not considered to be important for the work of the group. Instead, other mechanisms and functions that encourage the students to work within their projects are described, and are implied to overshadow grades.

During the first interview with Albert, he declares that the grading is not important for the work of his group:

Interviewer: But this different grading, do you think it would be um, is a factor that might be a problem for the project?

Albert₁: Um, I don't think so, not in the project aspect, I think that might be disappointing maybe to hear that the Swedes or to the US that one is being graded differently to the other. But, you know, I feel that, you know, if you are a group you should work hard to the best of your ability whether you are being graded on it or not, or which style of grading.

Interviewer: Have you got a feeling that this is how it is? That people are, people are working independent of that grading.

Albert₁: I think so, yeh, I don't think it's been mattering too much in our group.

Albert argues that working in a group is more important than the grading for the project work, even though he acknowledges the potential for unfairness.

Andy, during the first interview, gives another factor, presentation, as important in contrast to grading:

Andy₁: No, OK, that's certainly how they feel, they're worried they won't bother 'cause they're going to pass anyway. But it's generally not a problem at home, I think, 'cause everyone wants to do a good job and not be ashamed when they present it

He argues that wanting to show good work at the upcoming presentation is important. Since Andy earlier during the interview refers to the group, to group discussions about problems, and the group as a unit that works together, his statement about not being ashamed does not refer to him being ashamed in front of the group, but for him not to be ashamed of the work of his group, and that this is more important to them than the different grading systems.

The grading system as potential for giving feedback is denied elsewhere in the interview, and contrasts feedback for grades or feedback for quality:

Interviewer: No.. is it a common idea here, d'you think, that grades, that they influence...

Andy₁: Yeh, it seemed so at the meeting anyway, 'cause I hadn't thought about it, but at the meeting they said, we've got to get feedback to know how we're going all the

Table 1. The ways of experiencing grades discerned among the students

	<i>Category</i>
1.	Getting good grades as a goal in itself
2.	Grading as an unimportant feature of the work
3.	Grading as an obstacle

Category 1. Getting good grades as a goal in itself

In this category, getting good grades is a goal in itself, either on behalf of the individual or of the group. The grade as a measurement is stressed and the possibility of obtaining good grades is described as important for the work.

One aspect of this category is illustrated by what Alec says during his first interview:

Alec₁¹: If my class were pass/fail here, and the rest of my classes weren't graded as they are, I would not put as much effort into it. I've already noticed a lot of my classes are lacking in grades because I have to put so much effort into this project.

The grading system is being stressed as important for his decisions on where to put his efforts. The fact that he mentions that he is lacking in grades in his other courses, underlines the importance he puts on the grading as an objective for himself and his own work. Elsewhere in the interview he explains that the grades are important for his future career.

Alec₁: Um, here I know in Computer Science as far as graduating, um, a higher grade point is very important. Um, anything, I would say below a 3 is.. um, you're cutting out your job options.

Another illustration comes from Anthony, during his first interview, when he says that the grades are important in their own right:

Anthony₁: [...] Whereas we really want that A, 'cause we know we can get that A, and we deserve that A, 'cause we've been working hard on it. And actually that just came up in our IRC meeting today, um, Annelie, the Swedish group member, asked, "Are you guys really concerned about the grades?". And yes, it really, it reflects upon us, showing that we did our work, what we've accomplished.

Getting a good grade is here expressed as important for the group, since it shows that the group has done a good job. Annelie's reported comment, "Are you guys really concerned about the grades?" implies her surprise at how the potential of a grade is driving her group, and even that it is not the normal Swedish attitude. A difference between Anthony's and Alec's argument is worth noting: for Alec, a good grade is important to himself, as an individual with his future in sight, while Alec stresses the importance of the grading for the group as an acknowledgement of their competence.

At the beginning of the course, the different grading systems were a concern for Adam. He explains his thoughts in the following way:

¹ The American students have been assigned names beginning with A, the Swedish with S; the suffixed number, 1 or 2, indicates the interview set from which the extract is taken.

The goal of a phenomenographic study is to reveal the variation of ways in which people of a particular sort (a student cohort, or a students of a particular subject, for instance) experience a phenomenon (Marton, 1994; Marton & Booth, 1997). There is, however, no direct access to experience; the nearest we can get is to talk to people, or observe them closely, or study artefacts they produce. The most usual form of data collection in such a study is the open, semi-structured interview in which there are a small number of predetermined themes to talk of, and where the interviewer is prepared to follow up interesting new themes as well as to bring an interview back on track if it seems to be losing focus. The interviewees are chosen to represent a variety of backgrounds and types within the whole group. The balance between interviewer and interviewee is a delicate one and the interviewer has to take care to maintain it, by establishing a common ground from the start and by ensuring that the interviewee has opportunity to express themselves openly and fairly. Interviews are recorded and transcribed carefully, and the texts provide the basic data.

When a phenomenon is identified as the object of study, text passages are extracted that refer to the phenomenon, either explicitly or implicitly, and these are studied for the meaning expressed there, both as individual expressions and as a collection of meanings. We refer to this as the pool of meaning, and here the analysis starts. The text is read many times, in different ways, sometimes studying a piece in its original context, sometimes studying groups of text extracts that seem to have commonalities or distinct differences. The aim of the interpretational analysis is to reveal qualitatively distinct differences in the meanings expressed, and the interpretative process can be seen as constituting a collective of meaning out of the collection of text extracts. Categories are formed and reformed, tested and re-tested for inclusiveness and distinctness; they should cover all the data and there should be no overlap. But note: phenomenography is not about categorising people – it is about categorising the meaning that is seen in the pool of meaning, and one respondent can contribute to more than one category, even in one short piece of data.

If the data is good enough – which implies that it has been taken from an adequate variation of interviewees, and the interviews have been sufficiently open for a variety of experiences to be voiced – then an interesting set of categories emerges, providing a set of high resolution snapshots of the collective experience of the interviewees, and, by considered extrapolation, of the class they were drawn from. The categories are described carefully and the main aspects of them are illustrated by relevant interview extracts. Here we will present the results of the analysis of the data pertaining to grade and grading systems.

The results of the analysis

Initially the students were asked during the interviews if, and in that case in what way, the differences in the grading systems affected their work. Their answers to the question, and the follow-up discussion that took place during many of the interviews took up both the influence of differences in the grading systems, and the effects of grading as such. In this section, we analyse the students' experience of the grading and its influence on their work, without paying a special attention to differences in grading systems.

As presented in Table 1, we have revealed from the data three qualitatively distinct ways in which the students experience the grading, and its importance.

The phenomenographic study

The phenomenographic research approach has been adopted because we are trying to capture the variation in ways in which the students experience a wide range of phenomena in their learning situations (Berglund, 2002; Marton & Booth, 1997; Booth, 1992), and in particular we aim to maintain the character of the computer science knowledge and environment in our descriptions. We are striving to describe learning as it is experienced by the learners, rather than as it is understood and spoken of by the teachers. Further, we have been strongly influenced by activity theory in our reasoning, in particular by activity systems, when considering the experience of the learning situation as a dynamic system of people and artefacts as well as institutional features. Thus, the phenomenographic results are in turn related to an organisational scheme where the context is characterised as an activity system (Engeström, 1987; Engeström, 1993; Holland & Reeves, 1996; Nardi, 1996).

In this paper we are concentrating on the grading systems as a feature of the institutional setting for the students' learning, which we have first studied through the analysis of two sets of phenomenographic interviews and then considered in the light of the structure of an activity system. When designing the Runestone course, consideration had to be made of the fact that are the different grading systems in the collaborating universities, namely pass/fail and A – E in Sweden and USA respectively. Thus, an issue of discussion among the staff has been if, and in what way, the different grading scales influenced the results of students, and whether the different grading would be regarded as unfair by the students. There is much research on the effects of assessment and of different assessment systems on the performance and the understanding of students in higher education (for example, Vos, 2000; Hargreaves, 1997). A general conclusion is that the form of assessment does indeed have a decisive effect on how students approach their studies. And a general observation is that a highly graded scale tends to encourage a superficial approach whereas a scale with a small number of stages encourages focus on the object of study (Trowald and Dahlgren, 1993)

Now, in this project-based course for students with several years of university studies behind them, worries concerning the nature of the experience of assessment as such was not considered much more than as a problem of providing equity. Thus to support fair grading across the whole project, the work was marked individually on a weekly basis, on a scale that was designed for the course (Pears et al., 2001). The score was then transformed to a grade, corresponding to the different grading systems.

Thus, when the students were engaged in interviews in the course of this study, it was natural that the issue of assessment and grading systems was taken up, and the issue of their nature, their effects, their fairness would be aired. And so was the case. The grading systems were seen by the researchers to be not so much an issue for the individual and her or his approach to the project and the course, but more of an issue of comparison and uncertainty about the system as a whole. As the quote used in the title of this paper suggests, there was some surprise over how group members at the other institution experienced their own and the other systems.

In the course of the interviews the overall project was discussed before entering into details of the technical solutions, and here certain phenomena were touched upon to elicit the interviewee's views and ideas, one of them being the grading systems employed. The results to be presented below consist of an analysis of both American and Swedish students expressions on this topic. Before proceeding to the results, a word on the phenomenographic research approach is needed.

The Runestone initiative

The Runestone initiative is a joint research and development project, based on a project-based course in computer systems and software engineering, given jointly by the Department of Computer Systems at Uppsala University, Uppsala, Sweden and the Computer Science and Information Systems Department at Grand Valley State University, Allendale, MI, USA (Daniels et al, 1998, Daniels, 1999, Hause & Woodroffe, 2001, Last, 2002). The course participants, who are third or fourth year students in computer science, work jointly in groups of six students, three from each institution on an advanced software development project. The task given to the students was to produce working software that allows an end-user to "play" over the internet with a modified version of Brio labyrinth (left-hand photograph in Figure 1), a Swedish toy in which a tilting platter with a maze of paths and holes is manipulated by rotators, the aim being to get a ball through the maze without falling into a hole (Berglund, 2002).

To complete the task, an extensive collaboration over Internet was needed within the groups. For the version adapted for the project, each piece of equipment had motorised rotators which were controllable remotely, and feedback on the location of the ball was given to the system by a video camera, as in the right-hand photograph in Figure 1.



Figure 1 A Brio labyrinth, and a modified version with a camera and motors added

The course has been given since 1998, during the first year with a pilot group, and in the following years in full scale, with between 45 and 96 students. When the course – that demands collaboration between students from different countries – was being designed the teachers had to consider differences between the institutions, such as the university systems, student population, cultures etc., as well as language and background knowledge. During the following years, new teachers have been assigned to the course in both countries, and the equipment used for the assignment has been changed. Thus course has become institutionalised, and is today a natural part of the activities of the two institutions, but there is no longer necessarily the same degree of concern over potential differences.

The results presented in this paper are based on eighteen interviews performed on two occasions with students at both universities during the spring of 2001. The interviews were performed by the first author in Swedish with Swedish participants, and in English with American participants as well as with one non-Swedish speaking student in Sweden. A more elaborated description of the students interviewed and the interviews can be found in Berglund (2002). Altogether 95 students, distributed over 16 groups, attended the course in 2001.

"Are you guys really concerned about the grades?"

On the experience of grading as contextual to learning in an internationally distributed computer science project course.

Work in Progress

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Introduction

The question that is being addressed in our research concerns the ways in which students experience learning in a particular university computer science course, and encompasses experience of the *content* of learning (communication protocols and their application), *approaches* to learning tasks (large projects distributed over groups of Swedish and American students), and the *context* of learning (the situation constituted of features experienced as relevant to learning, but are other than direct content or task). The overall aim is to produce a rich analytical description of the variation of experience of the learning and learning situation, in order to inform and influence the design and execution of similar learning situations. The variation in ways of experiencing communication protocols has already been analysed and described (Berglund, 2002). This paper focuses on the ways that the Swedish and American students experience what is one of the foremost institutional contextual features of their learning situation, namely *the grading systems* that are being employed at the respective university departments.

First, the course of study which is the background to our study is described, and the context that is prepared by the teachers in America and in Sweden. Then the phenomenographic research approach that we have adopted will be described. The empirical studies that have been carried out to chart the variation of ways of experiencing certain features of the learning situation will be presented, and the results will be related to activity systems to describe the experienced context of learning.

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