

Explorative Evaluation of Courses in a New Bachelor Program

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ABSTRACT

Many course evaluations tend to focus on teacher performance and whether students like or don't like the course or the teacher.

An explorative evaluation method has been developed and tested. This method has emphasis on how and when students learn during a specific course and which learning activities enhance the learning.

This explorative evaluation method is closely connected to the course evaluated and is therefore meaningful for the students. The method has been tested on both interdisciplinary CDIO-projects and traditional introductory programming courses in the new Bachelor Program in Healthcare Technology at Engineering College of Aarhus.

This paper presents the method and the results from two evaluations of a programming course in first semester and two evaluations of an interdisciplinary CDIO-project course in third semester. The evaluations took place in January 2010 and January 2011.

KEYWORDS

CDIO Program Evaluation (standard 12), Explorative Evaluation, course evaluation

INTRODUCTION

In august 2008 a new Bachelor Program in Healthcare Technology started at Engineering College of Aarhus.

The Program contains 3 equally weighted disciplines on the first 4 semesters: Biomedical engineering, Software engineering and Healthcare (physiology, pathology, humanities and social sciences). The fifth semester is internship in a national or international engineering company or at Department of Clinical Engineering or a research facility at a hospital. In the last 2 semesters the students select optional courses and make their bachelor project.

This article focus on evaluation in the software engineering discipline, because experience shows, it is the most difficult discipline the students meet in this program. Software engineering courses contains very abstract concepts that are difficult to relate to previously learned skills. The students find that learning programming is like learning a new language without a dictionary, and the teachers find that these students are very hesitating in trying to work on their own. In that respect they act different from students in the ordinary Software Engineering Program. The teachers who are experienced in teaching have been very much challenged.

The students tend to blame the teacher, when they find a subject or task difficult to learn. Besides that many evaluation methods like questionnaires tend to evaluate the teachers performance, teaching skills or personality [1].

The challenge is to develop and test a method with emphasis on how and when students learn during a specific course and which learning activities enhance the learning. It is important to involve the students, listen to their reflections but also to have a dialog with the students and make them reflect on their own role and influence on the course and their learning process.

THE EXPLORATIVE EVALUATION METHOD

In a workshop a common learning path (Figure 4) of the course or project is generated through a dialog between the students and teacher(s). The dialog is guided by a process guide. The picture generates a common reflection on the learning process and this leads to some recommendations for the future development and implementation of new learning initiatives in the course.

Preparation for the workshop

The evaluation is performed at the end of the course. A group of randomly selected students are invited to participate in the workshop. The students should represent the different groups of students in the class (gender, age, professional level, ethnicity etc.) The size of the group is 6-8 students because it is difficult to create and get at clear picture of the learning path with a larger group.

Find a nice room where you will not be disturbed, make arrangements for coffee and cake or fruits to make an informal and good atmosphere.

Before the workshop, the teacher(s) create(s) a timeline with the course subjects listed (Figure 1 and 2).

The Workshop

The duration of a workshop is 1½ hour. The process guide introduces the students to the method. They should understand that students and teachers are on a common exploration tour to find out about this learning path, what happened, what did students and teachers experience (without interpretation [2]) during the course. Experiences are illustrated by the symbols (Figure 3). It should be clear to the students that everybody listens to each other and that the outcomes from this evaluation will be used to improve their courses in the next semesters. The teacher(s) participate(s) in the workshop on equal terms with the students.

The workshop is divided into four parts:

1. An individual reflection on the subjects and learning outcomes. It takes around 20 minutes. The participants get an A4-paper with an empty learning path (figure 1 or 2) and some stickers with the symbols selected for the evaluation (Figure 3). Everyone have to reflect individually. The teacher(s) focus(es) on their experience with the reactions of the class through the course. During this part some relaxation music is played.

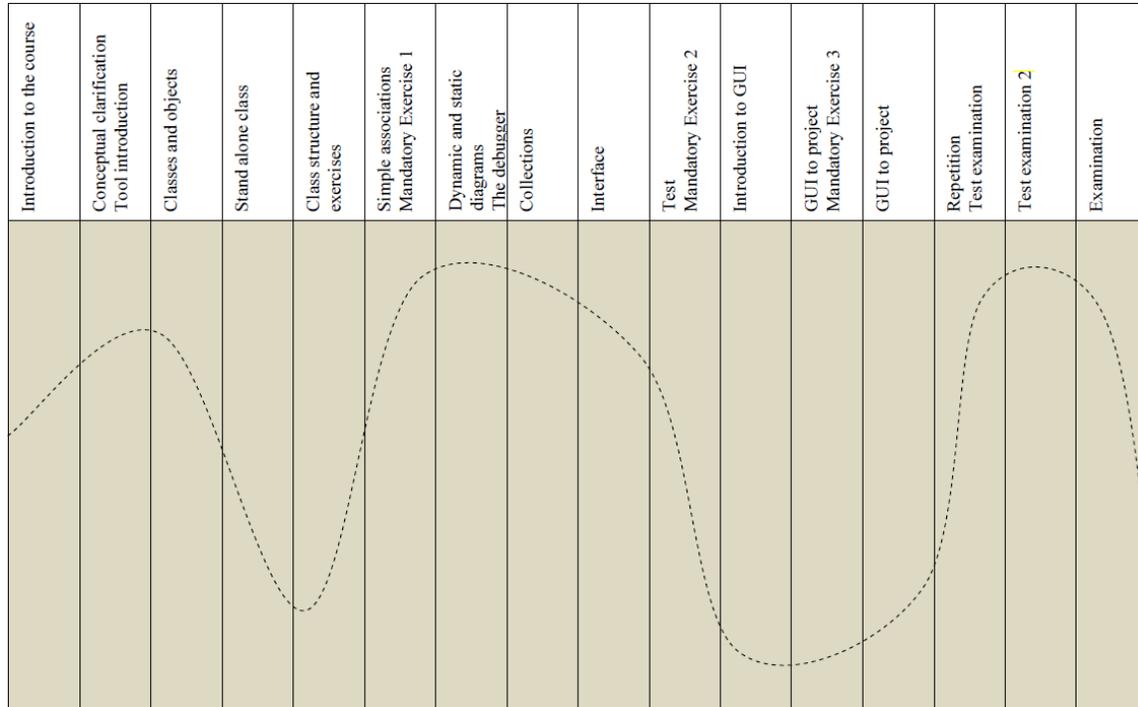


Figure 1. A learning path for ST1ITS1-E10

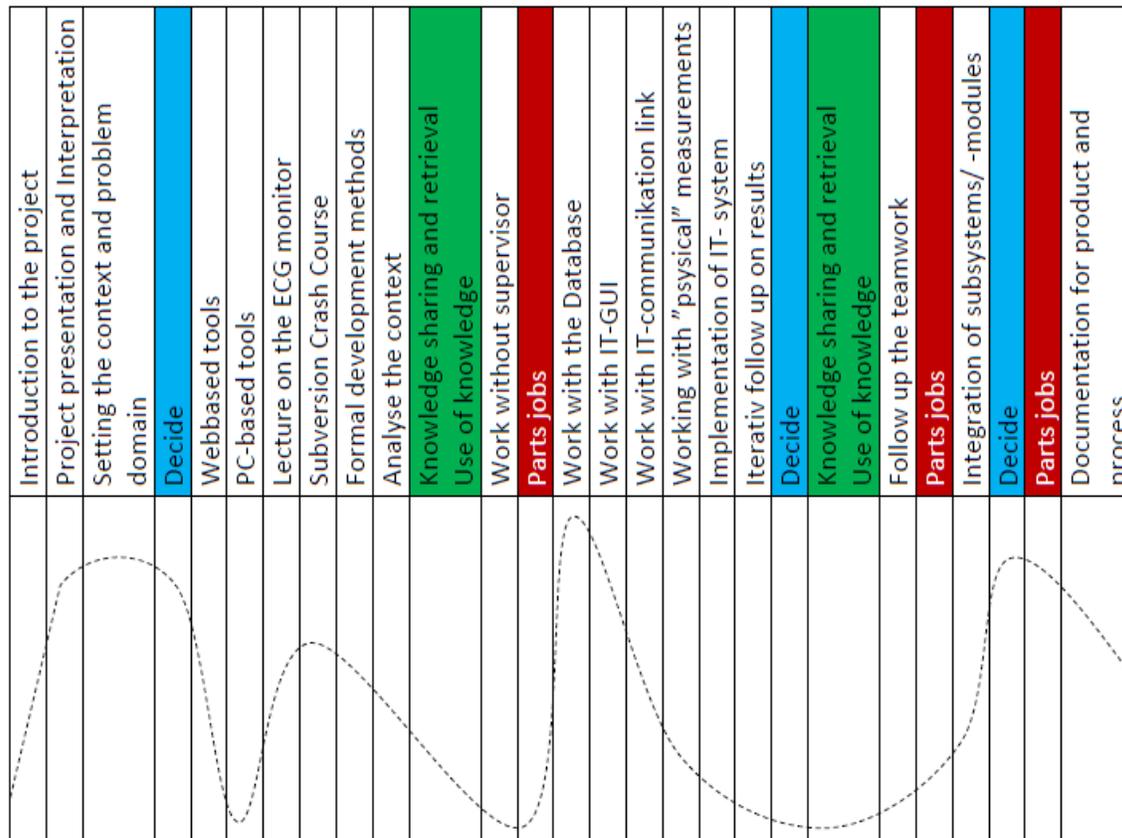


Figure 2. A learning path for the project course ST3PRJ3-E10

2. Generation of the common learning path. The students add stickers to a large paper with the learning path as shown in figure 1 and 2. During that process they add some comments to some of the stickers. The teacher(s) do(es) the same. When everyone has added their stickers, the process guides identifies some patterns from the common picture and list these at a whiteboard. The students help prioritizing the list and a couple of items are selected.
3. Reflection on selected patterns from the learning path in smaller groups. The group of students is divided in two groups (3 to 4 students in a group) and each group gets a subject from the list and makes a brainstorm for ideas for improving the course.
4. Reflection on the evaluation process. The process guide asks the students for comments on the evaluation process, and thanks for their participation. At last the teacher(s) promise to create a summery for all participants of the course, with the changes for the next conduct of the course and elements to bring for the subsequent course.

During the creation of the learning path (parts 1 and 2) the following categories are used (more can be added if relevant):

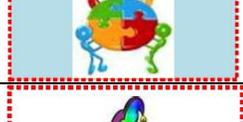
a		AHA – when did you collect the treasures?
b		Time Pressure – when did you feel the time pressure?
c		Workload – when did you feel a heavy workload?
d		Clarity – when did you know the goal and contents of the course (+ on the sticker)? When were you uncertain about the goal (-)?
e		Reading – when did you find the literature difficult or too much?
f		Experiment – when did you feel that you practiced and experimented in the course?
g		Teamwork – when did you work as a team? When did your group work with the other groups? (only used for ST3PRJ3)
h		Joker – what else did you experience?

Figure 3. The symbols are selected to make it easier to remember the meaning.



Figure 4. A learning path with posters

RESULTS

Results will be divided in two parts, the programming course and the CDIO-project course.

Programming course in 1. semester

The main themes in the evaluation on the programming course the first year (2010):

- Time. The students are stressed for different reasons, there are too many themes in the course, and they have not time enough to 'consume' it all. They find it is difficult to read what is expected from week to week, and they fell there is too much to learn.
- Reading. The book is difficult to read, and they cannot figure out what is important and what is not.
- Assignments. They learn a lot from the assignments and exercises and the pattern in the learning path shows that there are many stickers a (treasures) in connection with stickers f (experiments). They are kind of frustrated when they work on assignments in class because everybody wants the teachers help all the time.
- Concepts, some students explained the heavy workload and lack of clarity as a frustration because it is difficult to remember and understand all the new words and concepts.
- Clarity. During course students find learning targets difficult to understand.
- Learning. It is clear from the learning path, that students learn the most when they work with assignments and when they work hard and concentrated individually.

The learning path created is very useful as a starting point for reflections and discussions. Students discuss with other students and with teachers. The dialog is very important and gives much knowledge of the learning process for the students in the course. The course had been evaluated orally in the class half way through the course. Students said they didn't learn very much and they were frustrated and blamed the teacher, but the teacher got very little help to find out what to change.

The final results of the evaluation are some recommendations for the coming courses in programming.

Students ask for reading instructions, which can guide their reading of the book. The teacher comes up with the idea that students create their own kind of dictionary as a little assignment to every week through the course. The exercises can be divided into smaller assignments throughout the course. They should be very easy from a start and give the students motivation. The teachers try to implement the advice in the second semester courses for these students and also in first semester for coming students.

When this course is evaluated in 2011 the patterns are:

- Exercises and small assignments. They are very good. Test before examination was really good, more would be even better.
- Time. Students still find there is a time-pressure; there are still many themes and they spent a lot of time working with their homework.
- The dictionary. It is helpful but it takes a lot of time.
- Hard work. It is hard work to learn programming

The changes to the course made a huge difference. There is a discussion during the evaluation on how to encourage students to be more experimental and try to find out themselves what works and what doesn't in the exercises. Students are well aware that it takes hard work to learn programming. It also counts on the positive side this year that evaluation is after examination where most students got good grades and only a few failed, but it is obviously a result of the positive changes.

Everybody agree that it is important to keep high learning targets but the GUI-theme can be taken out and placed in a CDIO-project course.

DCIO-Project course in 3. semester

In this project the students are working on ECG signals in an open source system. Students are divided into groups and the groups have each their job to do, but in order to reach the learning targets in the project course they need to work together on some parts to make their systems communicate with each other.

The main themes in the evaluation on CDIO-project course (2010):

- Teamwork and dialog in the team. The students are experiencing a lot of problems in the teams regarding collaboration. This is generally a problem in this class. The good question is; how do we make good and well-functioning teams? How do we solve collaboration problems?
- New knowledge. Some of the students find it difficult to find the knowledge needed in the project. They would like more teaching/guidance in the unknown theory and technology.
- Unclear requirements from teachers. It is not clear to the students what the requirements are to the written report so they waste a lot of time discussing with each other and asking the teachers. They find learning targets unclear.
- Experiments and learning. Learning path shows that experiments and learning are closely connected. Students say that it's a very interesting project and a very close to reality-project. They have learned very much in this course.
- Communication between teams. There seems to be certain mistrust between teams, and teams don't want to help each other. Students want the teachers to

play a bigger role in facilitation collaboration between teams and to make teams for their next projects.

The most important issue in this evaluation is that all the problems with communication and collaboration between persons and between teams come to the open. This makes it clear to teachers that this group of students need help to manage team problems and that they need support in their next semester project.

When the evaluation is made in January 2011 themes are different

- Uncertainty about project. Students are uncertain on many things in the project; what different teachers expect and understanding learning targets. They find it impossible to reach the learning targets and that makes them very frustrated.
- They find the project very interesting and close to reality. They say they are too frustrated about many things but they have learned a lot
- Communication and collaboration within the teams function very well and also between teams. They have learned to collaborate and to find knowledge and use other people's knowledge.
- Experiments and data. Experiments and work on data are useful and connected to learning, but takes (too) long time. The progress in the project was too slow from the start.

This group of students find the project very difficult but they did actually very well in the final examinations, which took place before the evaluation. The students in this group have very high expectations to themselves and they work very hard to reach the ambitious goals. The evaluation gives valuable information on how and when the project should be presented for the students and the formulation of the learning targets. Like the first time this project-course was evaluated, the results give a lot of information on the group of students and how they learn and work together.

The evaluations of the CDIO-project course give very important information on how students experience that kind of team-work. The theme of the CDIO-project is great but teamwork is difficult. It shows how important it is to be aware of teams and to get involved as a teacher before problems affect the learning and outcome. But it is considered to be a very important part of the study to learn how to deal with team processes, problems and collaboration.

DISKUSSION

The purpose for this course evaluation is to enhance the students learning and to improve quality of the content and structure of the course. That calls for methods with focus on learning, cooperation between teacher and students, and structure in teaching [1]. The students are asked how they experience teaching and learning. It is important to distinguish between assessment and experience. The data from the students experience can be discussed and interpret by the teachers and students in the following process. The stickers on the path tell how the student experience. This is a qualitative method that gives a deep insight in how the participating students learn, how they understand and the data from the evaluation are in that respect subjective and derives from a few persons perspective [3]. It is difficult to synthesize and summarize the results [3], [4].

Would data be different if the six students were replaced with six other students? Yes, but the evaluation is very closely connected to the themes in the course and the students are reflecting and discussing, and in that process they agree on the main issues in the evaluation. It is believed that the issues would be almost the same in another group of students. The collected data are extensive and give the teacher useful information which obviously in the case with the programming course has had a positive impact.

The evaluation is an open dialog, were the teacher is present and that might hinder negative expressions from the students. On the other hand students show great responsibility and commitment and are very constructive. As students are involved in a dialog it is important that they agree to the summary presented to the class. It is difficult to engage students in evaluations if they don't see the results and even more difficult to engage them later on in future evaluations if the advises and discussions are overheard [2].

The first evaluations were guided by an external consultant who was also helpful in describing the evaluation method.

In 2011 the director of studies in Healthcare Technology has guided the evaluations. The close connection to teachers and to students is not considered to influence in a bad way. It is very important that there is trust and a good atmosphere, and that the teachers show that they want to listen and learn. As a process guide it is a difficult job to balance the themes and give everybody time to speak and it is also a difficult task to keep focus. Even though the visual result of the evaluation is a common reflection on the learning process, it is clear that the students also get important reflections on their individual learning process.

CONCLUSION

This kind of evaluation is very time consuming and is not intended to be used at the end of every course. But it is very useful in newly developed courses, in courses where other evaluations show discontent from students or where results are difficult to interpret. This was the case for the two courses evaluated.

The purpose was to test an evaluation method which would give the information needed to enhance student learning. This explorative evaluation method has this potential. The programming course is getting better and better, the students learn more and more, and they are less frustrated as is the teacher. The focus on how the learning processes and teaching is experienced and the dialog has been the key to understand what to do.

Regarding the project courses the most useful contribution is the information on how specific groups of students work and collaborate and therefore helps teachers to enhance guidance and performance for that group of students.

[1] Andersen, Hanne Leth og Louise Søndergaard (2006). 'Undervisningsevaluering som redskab til kvalitetsevaluering af undervisning'.
I: *Dansk Universitetspædagogisk Tidsskrift* nr. 2/2006, s. 22-35.

[2] von Müllen, Rikke (2006). 'Underviserevaluering og udvikling af underviserkompetencer.'
I: *Dansk Universitetspædagogisk Tidsskrift* nr. 2//2006, s.16-21.

- [3] Christensen, Gerd (2010). 'Evaluering af evalueringer'.
I: *Dansk Universitetspædagogisk Tidsskrift* nr. 8/2010, s.10-16.
- [4] Undervisningsevaluering. Dansk Evalueringsinstitut. 2003.

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