

Establishing Project Based Learning¹ - Emphasizing Assessment, Examination and Feedback

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Abstract

In the project we have worked with the main objective to evaluate, improve and develop new assessment, examination and feedback forms for students working in projects. We have developed capabilities to assess and examine student work in both individual work and group work and to give meaningful, high quality, feedback on students' achievements. We also took both the learning process (recurrent examination and feedback) and the product (the learning outcome at the end of a particular course) into account. The main objective of the project was to establish a model (framework) for assessment, examination and feedback of student work. The model is published in this report together with a set of application settings, related to theories and reflected upon.

Keywords:

Examination, assessment, feedback, information systems, project

¹ The original title of the project was "Establishing Project Oriented Student Work - Emphasizing Assessment, Examination and Feedback". We now use "Project Based Learning" instead. An expression better anchored in empirical and theoretical work.

² From January 2007 we are a part of a new department: Department of Management and Engineering. When the project started in 2005 we were a part of the Department of Computer and Information Science.

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1 Introduction

1.1 Rationale for change

When we initiated the project in 2004 (and started in 2005) there were an overall need for improvement of students' learning and our teaching in the Information Systems area. Pedagogy was one area within the subject of Information Systems that needed to be improved and revitalized according to a quality evaluation of the Information Systems Analysis Programme at LiU (Stolterman, 2000). The fact that project work was an established part of the trade and industry, and certainly the IT sector and the systems development area, was also an important call for the need of the students to have project skills.

In our undergraduate courses in 2005 the students were confronted with a varied set of principles when assessing and examining work (e.g. in object oriented systems development courses, systems design courses, electronic commerce, scientific method courses). We identified that this variation and diversity of course could be stimulating for students' learning, but it could also be confusing when it is not well thought-out and carefully planned from the organizers (teachers). We identified a need to be more systematic, and "student sensitive", in our choice of assessment and examination forms and methods in order to assure the legal rights of the individual student (in examining and grading) and to give the students a high quality feedback. The problems with the feedback were, according to the students, that it was related to a project group's joint achievements, instead of being related to individual achievements (sometimes vague). The students also felt that they were not given enough feedback (volume and quality). Our initial analysis of the students' attitudes towards examination shows that they were concerned about unfair grading when working in project groups (Melin & Cronholm,

2004). The risks for so called free-riders were evident. This was considered to be a major problem that needed to be dealt with when working in project groups and its point of departure for assessing and examining student achievement. In order to reduce these risks, the conditions concerning the visibility of individual performance were highlighted as a key issue when developing methods and approaches for assessment and examination.

A more systematic and scientific approach to organize for assessment and examination (including feedback) therefore needed to be established. The integrated approach for assessment, examination and feedback had to be an integrated, natural, part of students' learning and improve the students' conditions for learning in a project oriented setting. These issues are important aspects of the outlined framework in this report and important activities in the project. The systematic and scientific approach, is, besides being a part of the recurrent educational effort, an important characteristic and a point of departure in the present project as a temporary development process.

1.2 Review of relevant literature

The theoretical underpinnings for the framework and other activities in this project are summarised below. In the paper by Melin, Axelsson and Wedlund (2006) a comparative analysis of our efforts and other similar initiatives is presented. The CDIO³ initiative is one example, capstone courses is another and Problem Based Learning (PBL) (e.g. Abrandt, Dahlgren & Dahlgren, 2002) is a third, also presented in the introduction of this report together with references to Student Centred Education (SCE) approaches and ideals. SCE is also a guiding-star in the texts below. Another important initiative that connects well to our efforts is the European Commission's work on standards and guidelines for quality assurance in the European higher education area (ENQA⁴).

The need for resources when designing courses with the profile suggested in this report is also discussed by e.g. Gupta and Wachter (1998) and Clear et al. (2001). In the former source we can identify several "guidelines for success" when designing information systems courses. A subset of these guidelines for success are: to plan and to organise the course content well in advance, to ensure that the cases used are comprehensive and include a business context, to build an atmosphere of trust and respect between teachers and students and between students in order to make high quality critique processes.

Examination is a central part in the project. Jaques et al. (1989) present a range of examination methods that can be chosen when designing courses. Such methods are often seen as a way of checking what students have learnt and "a little more". Some functions of the examination methods are: provide students with opportunities to demonstrate their skills, by measuring the success of the course (in terms of outcome), testing the students' skills to perform under certain conditions, acting as a filter to determine students' progress, to motivate students, revealing and maintaining standards, and giving students and tutors feedback on how well the students have learnt (incl. strengths and weaknesses). Examination can be directed towards individuals or groups. When the

³ CDIO stands for: Conceive — Design — Implement — Operate. The CDIO initiative: <http://www.cdio.org>

⁴ For more information, see: <http://www.enqa.eu/>

examination is directed to groups the risk of the free rider syndrome is a well-known aspect. Assessing group work is therefore a challenging task for teachers (Gibbs, 1995).

Examination, as defined by Rowntree (in: Ramsden, 2003), is about knowing our students and the quality of learning. We try to understand students in all their complexity and their potential as learners of the subject matter (Ramsden, 2003). The examination of students learning should take both these dimensions into account and be a platform to mark students' progress and performance (Ramsden, 2003). We can, for example as teachers, mark the students' ability to recall facts, apply frameworks, perspectives or theories, to analyze different processes or phenomena, to make syntheses of different methods or theories, and to evaluate their own, or others knowledge constructions. This list is based on the taxonomy presented by Bloom et al. (1956). The latter categories are perceived as more advanced.

Significant themes and concepts within the present project is learning, assessment, examination and feedback. According to Packendorff (1995) a project is a temporary organization with a number of project members who are interacting during a limited time in order to reach a goal. Project based learning can be understood as a perspective and a way of organising education to support learning and can also be seen as an alternative to PBL (Abrant, Dahlgren and Dahlgren, 2000; Gibbs, 1995). We identify the CDIO (Conceive—Design—Implement—Operate) initiative for the engineering discipline (Bankel et al., 2003; The CDIO Initiative, 2006) as a corresponding alternative to PBL. PBL, CDIO and project based learning are examples of SCE forms, which emphasize learning in context, elaboration of knowledge through social interaction, and meta-cognitive reasoning together with self-directed learning (Gibbs, 1995). In the latter approach project orientation (with focus on milestones, organising support tools, evaluation etc.) is more emphasized than in PBL. The learning objectives that we use also tend to follow a certain course rather than whole semesters as in PBL; we also use project groups with different number of students (not necessarily 6 to 8 students as in PBL) and have more active teachers in the problem searching and definition phase than PBL. CDIO is a general approach in engineering and has several similarities compared to the project based learning discussed in this paper. We have identified similarities concerning aspects of for example the CDIO initiative's concept to provide students with an education stressing the technical fundamentals, and prepare students to be successful in the role of developing systems and products (Bankel et al., 2003). In the subject area of information systems we focus on organisational fundamentals and technical fundamentals side by side and focus on the development of information systems. This is also identified by e.g. Gupta and Wachter (1998) and (Clear et al., 2001) discussing capstone courses ("a capstone course may include a project or "research-type" experience [and a] relatively structured assignments, extremely open ended assignments or student created assignments" (Clear et al, 2001, p. 94).

We regard the initiatives taken in the present project as unique in our subject area, e.g. taken to account that we combine a project oriented approach with SCE and PBL.

1.3 Questions

Critical success factors identified in the start of the project were to:

- Be able to perform a critical examination of our own the assessment and examination methods and forms used in our Information Systems courses. Should we be able to make the examination of our own methods and approaches critical enough? Would the teachers be open enough to discuss their "own" courses?

- Would the refined assessment and examination methods and forms in use meet the high expectations of students?
- Would it be possible to implement a model for assessment and examination in “real life”?

The three sets of critical success factors are all extremely important in order to succeed with the efforts that are central in the project.

1.4 Importance of the project to you and why

In the 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 (2003) description of the concept. 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, organise for learning to take place. Students then experience the subject matter heterogeneously and structure their own knowledge (Berger & Luckmann, 1966; Lave & Wenger, 1991; Ramsden, 2003). We also try to encourage a holistic and deep approach to learning – a meaning orientation (Ramsden, 2003).

We also consider a project as an arena where we can create a situation that can be authentic (genuine in some way; a real-life scenario), for example, to take or create, products and processes that are present in trade and industry.

The taken standpoint that knowledge is a construction, context dependent and that a teacher needs to take that into account when designing and examining in courses is not particularly dramatic nowadays. To relate this line of thinking to a striving for authenticity in a learning situation is also an important in our subject area. The level of thing of these dimensions has however been more widespread in the project group working with the questions together.

2 Method

2.1 Students (who)

The subject area focused in this project is information systems (in Swedish: Informatik) at LiU. A major part of the students in the present subject area are students at the information systems analysis study programme (in Swedish: Systemvetenskapliga programmet) – a four year study programme with approximately 175 students totally. 25 of them are females and 150 of them are males in autumn 2006. The average student is 26.2 years. The number of students up to 24 years is 81. 25-30 years are 87. 31-35 years are 15. Over 36 years are 12.

2.2 Innovation (what and how)

During the project several activities in courses have taken place. Activities are reported mainly in the referred and attached papers.

A selection of the activities that we have performed is briefly summarised below.

- Pre planning/preparation, overall course design; planning, executing, evaluation are described in the context of a typical project based course at an introduction

level (Wedlund, 2005; Wedlund, 2007; Wedlund, Axelsson, & Melin, 2006). Wedlund (2007) also focus on different levels (micro and macro level) and a movement between entirety and parts when planning and learning in courses.

- Group formation (different approaches) and learning effects in project groups are analysed and discussed in Cronholm & Melin (2006).
- The organising of student activity in seminars, different roles in seminars and gender issues are discussed in Axelsson, Melin & Wedlund (2006). The course context is an e-commerce course at master level.
- The use and exposure of criteria when grading and the development of a model for student activity in seminars are discussed in Cronholm, Guss & Bruno (2006). Learning observation and the role of a meta-observer are also discussed in the same paper in the context of a joint course at our partner university Royal Melbourne Institute of Technology (RMIT), School of Business IT, in Australia. Similar activities have also been tested in an information systems methods course (2nd year) at LiU.

We believe that the innovative aspects of the present project is (1) the systematic way of handling project as a phenomenon together with SCE in a course process; anchored in practice and theory, and (2) generating a framework “Project Based Learning – A Framework for Designing Courses” (Melin, Axelsson & Wedlund, 2006) based on this. The systematic, research based, approach is showed above.

The students have participated in several activities above. The student perspective has been present e.g. in framing the problem and domain of the present project (see section 1). The student perspective have also made a great difference discussing and analysing group formation, seminars and learning effects above. The students have been active in the project internal workshops reported below and along the process of designing and testing our work in progress.

The work that constitutes the project has i.a. been performed in internal workshops. These workshops have been a way to make progress in our work, to make participation possible for teachers and students outside the project, to assure quality, and benchmark thoughts and ongoing results. The results have then been implemented and tested in everyday education and learning, and reported in conference papers.

The step-by-step progress in the project is very much in line with the planned execution of the project. The exposure of results (in conference papers) has exceeded our expectations and the planned activities related to this. This has been a positive factor for the project because it is an important way of quality assurance.

2.3 Procedures (how)

In order to assess the results of the project we made use of several data sources and approaches. First, we analysed documented, critical choices made by teachers in courses (e.g. by interviews with course leaders). Second, we analysed student led course evaluations. Third, we analysed students’ and teachers’ attitudes towards assessment, examination (grading) and feedback by using focused, destined, interviews and seminar activities in order to generate empirical data.

In order to assess the process in the project we have arranged seminars with recurrent self assessment and end assessment with actors within and outside the project. We have also used a benchmarking strategy involving other learning/pedagogical projects and

significant actors as a ground for comparison (i.e. LiU:s Centre for Teaching and Learning as a “speaking partner” and evaluator of our process and emergent framework).

When assessing the progress and the results of the renewal activities proposed above the students’ opinions have become central. We have a well developed framework for course evaluation managed by students that have served as a basis for assessing progress in courses and grades. Questions regarding i.a. project group work vs. individual student work have been asked, recurrent examination etc. The students’ experiences from the developed approach to project based learning are very positive, based on the evaluation questionnaires and statements from the students that participated in the project group.

Teachers’ reflections on using the framework for assessment, examination and feedback within project based learning have also been important inputs in order to assess the project results and the strategies to establish our efforts. We have also used “Muddy Cards” (direct written, anonymous, positive and negative feedback from students to teachers on small cards) to evaluate ongoing courses, another input to assessment. The major impressions from teachers using the framework are positive. Some negative aspects are identified concerning the academic freedom and the freedom of action from particular teachers. The framework has a role of directing action towards certain ideals for learning (student centred learning, project aspects, the importance of contexts and situations, a teacher role as being a learning facilitator etc.).

The work in the project has mainly been organised in two groups; an acting project group (the authors of this report), and a reference group with another lecturer and student representatives. The members of the acting project group have had the main responsibility for the progress in, and the publications from the project. The reference group has also been active in different phases of the project, e.g. when challenging perspectives, testing ideas in courses, discussing outcomes etc.

3 Results

In this section we summarise the results from the project, reflect upon them and outline future work (already initiated as well as potential work).

3.1 Summarising results

There are several apparent outcomes from our project. In this section we aim to summarise them shortly and comment on them regarding their main beneficiaries. The main anticipated outcome (a tangible result, cf. our discussion in section 1.2) from the project is of course *the framework for course design*. The framework embraces many detailed results of which we will concentrate on a few here. The framework is supposed to work as a tool for teachers when designing a course, but the outcome in terms of a well-designed course as well as its performance and evaluation is of course also of benefit for the students. The framework is divided into six themes: (1) overall course design, (2) formulation and communication of the project task, (3) composition and assessment of project groups, (4) design of examination, (5) feedback as learning and (6) course evaluation and improvement (Melin, Axelsson and Wedlund, 2006⁵). We have not identified any equivalent framework or model when searching in the area. We regard our model as being innovative and unique in this way.

⁵ Some later changes and additions are made to the framework compared to the ISECON version 2006.

During the last years of pedagogical development projects (2006) that our teacher team has performed, both *individual and collective knowledge* has been developed. Parts of this knowledge are enclosed in the framework while other parts do exist outside the framework as well. These latter parts could be defined as a more conscious attitude towards pedagogical and didactic issues. The project work has resulted in a *deeper understanding of both the teacher role and alternative ways to perform in that role*. As a result of these outcomes a higher degree of pro-activity among teachers is reached, instead of being mainly reactive. Planning is an activity that has been placed much more in focus thanks to the project. This is an example of a “local” innovation in our subject area at LiU.

SCE ideas have influenced us for a long time, but the project has provided for a greater focus on SCE aspects in the information systems area and our education. Effects of this is that we put *the student in centre* in a more distinct, and organised, way than before, both when planning and performing a course – using the developed framework. We do also encourage student activity to a larger extent now, which is obvious in our design of learning events such as seminars and workshops. Our insights regarding the student and teacher roles have also increased thanks to this. When understanding the distinct roles better it is also easier to both question the roles and to alter the content of the roles depending on context.

From a student point of view, outcomes regarding the process and support for organisation of student groups have been important. This is organised by the teacher in a much more conscious way than was done before and, thus, the project groups have better resources to handle both their tasks and upcoming conflicts. Another important result is our increased focus on examination from both a group and an individual perspective. We intend to assess knowledge on both the individual and the group level more distinct now. This has forced us to improve when handling group processes in parallel to examination of students’ performance in and outside a group. A way to achieve this has been to develop assessment criteria that are explicit and exposed, in order to facilitate a transparent judgement. In relation to this, feedback is an important issue. An outcome from the project is that our processes for handling feedback to students have been improved regarding its quality, volume, and frequency. The effects from the project are manifested in the student led course evaluations and in the informal interviews and discussions of students’ impression of the activities and improvements that was a result from the present project.

As a spin-off from this project we have also been able to perform a minor project on equal opportunities in relation to the emerging framework sponsored by LiU. This work has resulted in a better understanding of how different aspects within the field of equal opportunities (such as sex, age, sexual orientation, ethnicity, religion or other faith, disability or social background) can be treated when designing, performing and evaluating courses.

Altogether the outcomes have resulted in a more profiled education in information systems, where our valuations regarding higher education in general as well as information systems education in particular have become visible. This is of advantage to both teachers and students in the long run.

3.2 Summarising reflections

The aim of this section is to bring forward some reflections that have been done during and after the project. One of the foremost reflections is that we as teacher are much

more aware of different teaching and learning situations that appears. We are aware of that there are different issues that need to be considered. The existences of these issues were not obvious before the project started; sometimes they were not even visible. Often these issues mean that we have to make a choice between two or more alternatives. Thanks to increased knowledge the choices that we make are better reflected

Another reflection is about acceptance. Is the developed framework accepted by the teachers? Is the framework accepted by the students? We have so far not performed an explicit documented evaluation of the consequences of using the framework. However, our belief is that the use of the framework has rendered a lot of positive experiences and is on the whole is accepted by all teachers. This belief is based on both formal and informal discussion with teachers. There is no question about that the students are positive towards the frameworks since they have experienced a lot of advantages. For example they have got more feedback, group formation is more reflected and examination criteria are visible in before hand. Quotes from students read “the amount of feedback has increased”, “this is real feedback” and “we are now more familiar with how our reports will be assessed”. Another thing that strengthens us in or belief that the framework is accepted is that we have noticed that the students have become more critical towards courses in other subjects/areas that are not using the framework.

A third reflection concerns the development process. Thanks to the fact that we have used a systematic research approach, the development process the presented results are perceived as more credible. The chosen research methods are well reflected and the results are presented according to a publicity and dissemination strategy. That is, the results have been successively presented at selected information systems or computer education conferences, both national and international. In that way the status of the result has become more legitimised.

New ways of thinking of teaching and learning is not something that has happen over the night. We have had long term strategy that can be viewed upon as a “two-step-strategy”. The forerunner “GrundSIPA” project (sponsored by LiU) contributed with a formation of a base that has been used in the second step. The possibility of being able to plan the work according to a long term strategy has been invaluable. New ways of thinking of teaching and learning is not something that have been forced to the staff, rather they that have gradually matured.

The framework has been widely used within the subject of Information Systems courses. Most of the students that are taking courses in this subject are enrolled to the study program Information Systems Analysis (in Swedish: Systemvetenskapliga programmet). This program embraces several other subjects above Information Systems such as Accounting, Mathematics and Statistics. The ideas of the framework have so far not been transformed to these other subjects. One future aim is of course to spread the ideas to other subjects. In that way we are hoping that we can enlarge the scope of generalisation of the results.

3.3 Future Work

The efforts presented in this final report reflect processes as well as products (see e.g. section 1.2). The processes do not end with the project finish. Several spin-offs and future achievement have and can be made. Below we focus on an application⁶ to the

⁶ That received funding from NSHU and started in September 2007.

Swedish Agency for Networks and Cooperation in Higher Education (NSHU), a research education plan, further dissemination of results and an equal opportunities project achievement.

An application for an education network in Information Systems (together with university colleges in Borlänge, Borås and Jönköping) to NSHU has been selected by the agency to be included in application phase two. A full application will be handed in, in May, and have roots in significant results from the present project.

We also plan to discuss and disseminate results more thoroughly inside our university, but outside our subject area. The area of Economic Information Systems in our division is next in line. We also identify opportunities to discuss results from the present project in our new department context – the Department of management and engineering at LiU.

A research education plan has been put into execution as a spin-off from the efforts made in this project. Tommy Wedlund, lecturer and project member, has resumed his research education after an intermission. The thesis proposal and emergent thesis will focus on the core of the present project – project based education. The papers authored and co-authored by Tommy will serve as a point of departure for the forthcoming thesis, with a subject oriented didactic profile.

We have also linked another minor project on equal opportunities (besides the already performed initiative presented above) in relation to the project results that are presented here. This work is financed by LiU and aims at analysing and developing education information (e.g. at our web sites) from the perspectives of sex, disability and ethnicity. Education information concerns texts describing study programmes, course plans etc.

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