Software Project Management in Education

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ABSTRACT

Often problems occur in software development projects. They face problems with late deliveries, exceeds of cost estimate, failure to meet the requirements and so on. This study has been done as an action case study at the University of Trollhättan/Uddevalla. A course is performed in order to learn project administration. The course is arranged by influence of work-integrated learning. The students work with software development projects offered by external employers. It is important to improve the quality of the software project work.

INTRODUCTION

Many software projects have faces problems ever since software development projects have started in the middle of the last century. Problems like late deliveries, exceeds of cost estimates, unreliable software, failure to meet the requirements and poor performance of projects have not been too unusual.

Even though many people have tried to find solutions to these problems, is the fact that many of the software project problems remain. A suspicion to the fault is the approach to management of software projects. The projects have been managed of project techniques derived from other engineering disciplines. And these techniques have proved to be ineffective for software development (Sommerville, 2001).

The aim of this paper is to analyse a project performed within the educational setting in a Project Administration course at the University of Trollhättan/Uddevalla. The course contributes to the strategy of work-integrated learning. The research is performed as an action research as Vidgen and Braa (1996) called "action case".

RESEARCH METHOD

This study is performed as a case study (Easton, 1992), (Yin, 1994). It can be seen as a kind of action research. In fact, the concept "action case " can be used (Vidgen, Braa, 1996). In action research relations is established between the researcher and the participants. Action research can be done in many different ways. The method can be more formal with prescribed steps (Checkland, 1991). And there can be more informal ways to perform action research, with a more personal approach. Action case study involves both intervention and interpretation. The researcher creates intervention in the empirical area studied. The situations have to be observed and interpreted. This study has involved the researcher to a great extent. The researcher is the same person as the responsible lecturer for the course. It is the researcher who has done all the planning for the course. The course planning starts about three months before the course started. The course lasted for ten weeks. After that period there were some supplementary and evaluation work. Argyris and Schön (1996) also discuss about intervention for learning and research, but in an organisational learning approach.

SOFTWARE PROJECT MANAGEMENT
General software engineering approach
Management activities

Software projects are often much more innovative than other engineering projects. Different projects vary tremendously depending on the software product being developed and on the project organisation. The following activities Sommerville (2001) describes as the project manager's responsibility:

- Proposal writing
- Project planning and scheduling
- Project costing
- Project monitoring and reviews
- Personnel selection and evaluation
- Report writing and presentations

Writing a proposal to carry out the project is the first activity. Often it is the job of the project manager and it will be done before other personnel are selected to the project. In the proposal the objectives of the project will be described and it describes how the project will be carried out. Cost and schedule estimates will be included. Sommerville (2001) describes proposal writing as a skill, which is acquired by experience. He also claims that there cannot be set any guidelines for this task.

To identify the activities, milestones and deliverables belong to the project planning activity. The project plan is created to guide the development towards the project goals, and it is based on the available information. The plan will then evolves and will be revised iteratively as better information will be available with the progress of the project. Time scheduling is also included in the project plan. It implies to separating the total project work into separate activities and judging the time required, for complete the activities. It also involves co-ordinating the activities and organising the work. Often graphical notations are used to illustrate the project schedule. Anticipating problems, which might arise and prepare tentative solutions to those problems is also one of the tasks within project planning. As well as assessments of the constraints (required delivery date, staff available, overall budget etc) belonging to the project is taken into account. To make a risk analysis is am important task of a project manager. It implies to anticipate risks, which might affect the project schedule or the quality of the software product and to take actions to avoid these risks. The risks and the consequences of a risk should be documented in the project plan.

Cost estimation and estimation of resources is an important activity due to the possibility to accomplish the project plan.

The progress of the project must be monitored, which is a continuing project activity. Comparisons between actual and planned progress and costs must be done. Sommerville (2001) advocates informal discussions with project staff to predict potential project problems instead of waiting for schedule slippage to be reported. There should also be some formal project management reviews. It is the overall progress and technical development, which should be reviewed. Also the project's status against the aims will be reviewed.

Ideally the project manager has to select skilled people with appropriate experience to work on the project. But in most cases it is not possible to do this. One reason may be that the budget is not permitting the use of highly paid staff. Another reason could be that staff with the appropriate knowledge and experience is not available. The organisation's wish to develop the skills of its employees could be another reason.

The last management activity is report writing and presentation. It includes reporting and presentation to both the client and contractor organisations. It is therefore essential that the project manager have the ability to communicating, both orally and in writing.

Managing people

In a software organisation are the people a great asset. It is important that they have a reasonable level of responsibility and reward

that is commensurate with their skills (Sommerville, 2001). Good management of people is one of the most significant contributors to project success. The management has to do with technical problems as well as non-technical problems, like cognitive and social factors.

Quality management

The overall objective is to produce a high level of quality of software products. The developed product should meet its specification when it will be delivered to the customer. It is obvious that it is very difficult to write software specifications. It is the characteristics of the product that the customer wants, which are most difficult to specify. As Sommerville (2001) states, software quality management can be structured into three principal activities:

•	Quality assurance
•	Quality planning
•	Quality control

Quality assurance is concerned about organisational procedures and standards, which lead to high-quality software. Quality planning is about selecting appropriate procedures and standards for a specific software project. To ensure that the software development team follows the project's quality procedures and standards is called the quality control.

Process improvement

To improve processes is to understand the existing processes and changing them. The reason to change the processes is to improve product quality, reduce the number of defects and/or reduce costs and development time. Sommerville (2001) claims, "*there is a strong relationship between the quality of the developed software product and the quality of the software process used to create that product*". Process improvement is an iterative process on long term and it has to be supported by resources of the organisation.

The existing processes have to be analysed and documented. Then should bottlenecks be identified, which might influence the product quality. And the process improvement should propose new procedures, methods and tools to the problems. The new procedures, methods and tools will then be introduced and integrated in the development process. It is important with training to gain the full benefits from process changes. It also has to be a tuning phase where minor problems will be noticed and modifications are proposed and introduced.

The unified process approach

It is important to separate between "research and development" or "engineering" and "production" in software development processes in order to be successful. It means that too many analyses or paper studies in comparison to the emphasis on the construction or vice versa will be unsuccessful for software projects. Successful projects also tend to have a very well defined project plan with milestones, which bring the project from the engineering stage to the production stage (Royce, 2001). The earlier stage focus on achieving functionality and the later stage focus on achieving a product that can be shipped to a customer.

The engineering stage is decomposed into the inception phase and the elaboration phase. The production stage comprises the construction phase and the transition phase. The phases can be seen in Table 1.

These four phases are loosely mapped to the conceptual framework of Boehm's spiral model (Royce, 2001). The software development process should not be seen as a sequential process. The primary objective is to achieve an iterative process. Activities as requirements analysis, design, implementation and deployment are included in various proportions in each of the phases.

The inception phase is a kind of feasibility phases, where just enough investigation is done to support a decision to continue or stop. The elaboration phase is a phase where the core architecture is itera-

Table 1 The phases of the life-cycle process

Engineering Stage		Production Stage	
Inception	Elaboration	Construction	Transition
Idea	Architecture	Beta Releases	Products

tively implemented, and high-risk issues are mitigated. In the construction phase is oriented towards iterative implementation of the remaining lower risk and easier elements and contains preparation for deployment. The transition phase is a phase where beta tests and deployment are done (Larman, 2002). The product is supplied to the user community (Quatrani, 2000).

THE COURSE PROJECT

A course in Project Administration is performed at the University of Trollhättan/Uddevalla. The Project Administration course is a course within the Data- and Systems Science Program at the bachelor level. The course, which is studied, was conducted at half time in ten weeks in the spring 2003. About 65 students have attended this course at the same time. A course book (Wisén, Lindblom, 2001) describing the work in a project was used.

Course preparation

The course prepared by the author/lecturer was arranged within the concept of work-integrated learning. About twelve external employers were contacted in advance. The external employers were both non-profit associations and business associations. The external employers all have problems related to their information systems in their organisations. All of these twelve external employers had offered system development projects to be conducted by the students. All the projects were to be conducted within the framework of the course in Project Administration.

Course lectures and project work

During the first meeting at the course all of the external employers were invited. They had about fifteen minutes each, to do a presentation about their organisation and the project they want the students to fulfil. After this session each student had to choose to work with one of the presented projects. About six to eight students were finally allocated at each project. Then the student groups had to have meetings with the external employers to gather more information about the projects and what they have to do during the project time.

The first lecture in project administration was about how to work in projects and the different phases of a project. The student groups were assigned to work with the project and write a proposal for their project. All of the project members had to participate in the proposal writing in order to get the same framework, perception and information about the project. Each project also had to choose a project manager. About a week was assigned to the project groups to have meetings with their external employers and to write proposals, which should be checked with the employers. A risk analysis was also done at this time within each project group. The project groups had to present and show the lecturer and the other project groups their result after a week. Also a time account system should be presented by each of the groups. Ideas and feedback were given to the group by the lecturer, as well as by the students in the other project groups.

The second lecture was dedicated to project organisation and project planning. The students were also introduced to the project planning system MS Project. The project work was continued within the project groups. Each group had to plan the separate activities, which would be performed in the project. They also had to plan and allocate the time and the personnel resources to the activities. A project member was also dedicated to each project activity. Each project group presented the project plan after working with it in almost two weeks. Both the other students in the other project groups as well as the lecturer had an opportunity to give feedback and ideas to the project plans presented by the project groups.

There were even lectures about how to work in a group, and how to deal with conflicts in a group. One lecture treated leadership. There were also lectures about project management, project presentation and some various experiences from project work.

A tutor was assigned to each project group. So if any problems occurred during the project time or if any questions would have to be answered the project group had the opportunity to get help from the tutor.

The end of the course

The week before the course should end there were a session when all the project groups presented their results. All the groups as well as the lecturer were attending this session. All the groups were told to give ideas and advise to each other's presentations. This activity was done in order to improve the presentations. Each group had to present their results, both orally and in a written report, to their external employer during the last week of the course. They also have to give the written report and to deliver the system to the employer. The students also had to hand in their written reports to the lecturer in order to get a degree at the course.

PROJECT ANALYSIS AND DISCUSSION

The project start

All members in the project group did the writing of the proposal, even if the project manager usually does it. All the group members are already assigned to the group and it is of vital importance that they all have the very same knowledge about the problem and the employer's objectives. Senge (1998) claims, that "*many visions never take root and spread*". When the members in the project group work together the problem and the objective grows clearer, and it will be a benefit to enthusiasm and commitment. The project members otherwise can see different ideal objectives and solutions.

Sommerville (2001) says that there cannot be set any guidelines for the proposal writing. However, the course attendants get a framework on what should be described in the proposal. The proposal will be a kind of a control document for the project. It is always possible to go back and look for what was decided. It is the external employer who is responsible for the contents. The employer has to sanction the proposal.

In the first phase of the project the project group has to make a risk analysis. It is to anticipate problems and risks, which might arise. The probability and the consequence of each problem should be estimated and then the risk value is calculated. To problems or risks, which receive a high-risk value, preventive measures should be prepared. This activity is done in order to increase the preparedness of disturbance and problems and possibly also to eliminate the risks. The risk analysis is not a static document; it is to be gradually reviewed by the project manager. The time account system presented is aimed to create routines for gathering all time spent at the project by all the project members. The proposal writing and the risk analysis can be seen as the inception phase in relation to Royce (2001). Some elaboration is also done, related to the risk analysis.

Project planning

Cost estimation is not relevant to the performance of the projects within this course. The employers do not have to pay anything for the work. But it is necessary to estimate the resources needed. Especially in the project planning where the work is more detailed than in the proposal writing the resources should be estimated. The project members have to estimate how much time they will spend on each activity.

Time scheduling is an important activity in the project planning. The total project should be divided into separate activities. Then the time required will be judged for each activity. The project manager should also judge the required time for co-ordinating and organising the work. MS Project is needed to schedule the project. It will also give the opportunity to illustrate the project activities and their connections in graphical notations. The project plan will show milestones and the delivery date. It is the project manager who is responsible for the writing of the project plan but all the project group members are involved in the project planning.

The project managers in these projects do not have an opportunity to select skilled people and people with appropriate experience. They have to work with the allotted project members, and hopefully the skills of the project members will be developed. The project planning is most related to the elaboration phase.

Success factors

For a successful result of the project group it is needed engaged project members. It also claims that the group can make the necessary decisions.

The project manager has to be qualified and have the capacity to enthusiasm the project members. It does not mean to be the best to perform all the activities. On the contrary it will increase the risk to not give enough space to the project members. The project member also have to get the project members to feel that this project is the most important work to do and that it is the most exciting. It has to do with sustaining the interest and engagement for the project. It is even about to put the brake on to not get exhausted project members.

It is important to identify both the competence and the shortage of competence within the project group. This will be done in order to identify areas where the project members should develop their competence.

The project manager should work for good group dynamics and a good climate in the group. The project should also have realistic goals and ambitions. During the whole project it is the project manager' work to control the project process and the project plan and to continually follow up the project work to assure the project quality. The milestones should also be checked with the employer. The actual and practical project work is going on in the construction phase and some iteration within the systems development will take place. The transition phase is also performed during the project work. Before delivering the system to the employer it will be tested (Larman, 2002).

Project weaknesses

Some weaknesses have also been identified within the projects. There has not been any follow up of the milestones of the projects. In order to improve the project quality and the software process, planned meetings with the tutor, for example once a week, to report the actual status of the project could be performed. To get even better quality it would be possible to have at least one project meeting with the employer where the tutor also is present.

A good course book in Project Administration is a precondition to make a successful project in this kind of student course. If some information is missing or if the information is not elaborated as much as needed it is harder to perform the project in a good way.

Likewise it is of vital importance to have knowledge in how to write a project report. It is the responsibility of the project manager, and this should be emphasized (Sommerville, 2001).

CONCLUSION

The aim of this study was to analyse the Project Administration course with work-integrated learning.

It is argued that the project quality must be maintained. There could be some different ways to do that. One suggestion is to better follow up milestones. Another suggestion is to schedule regular meetings with the tutor. Project reports are important documents and should be written in an appropriate way.

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