

Patterns for Supervising Thesis Projects

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Abstract: Thesis projects are a challenging task for students as well as their supervisors. In most cases, students have not managed such large projects before. Many supervisors are good researchers, but have not received training in pedagogy and project management. This means that students as well as supervisors often lack best practices in managing thesis projects. This paper fills this gap by providing a set of best practices for the supervisor that may help to better structure and focus the collaboration between student and supervisor so that the thesis runs smoothly, thus enabling students to succeed.

1. Introduction

The following patterns describe best practices for supervisors of students' thesis projects. Students have to write such a thesis at the end of their bachelor, masters, or diploma program (the "Diplom" was the most common degree in higher education in Germany until the mandatory change to Bachelor/Master degrees). These projects are typically long-term interactions between the supervisor and the student that last between 3 and 12 months, sometimes even longer.

Typically, after they have agreed on a topic with their supervisor, students can take some time to familiarize with it and prepare for the official work term on their thesis. Ideally, they use this time to reach a good understanding of their subject and create a realistic plan for their practical and theoretical work. Quite often this precedes the time officially allotted to the thesis.

One common problem is that students and supervisor do not meet on a daily basis. Even if the students participate in a research group, typically the full-time researcher cannot interact with them all the time. In addition, many students have a part-time or even full-time job, so that the thesis work has to take place in the evenings or on weekends. This is especially the case at distance teaching universities like the FernUniversität in Hagen, Germany. Thesis projects are thus an example for a blended learning setting: Co-located synchronous phases of interaction interweave with phases where students work at home, following their individual schedules and preferences for the work setting.

Unfortunately, the freedom of working independently from the supervisor can lead to phases where the thesis moves out of the student's focus. Especially in distance teaching universities, we can observe frequent drop outs of students due to private matters or a high workload at the student's workplace. Students abort the thesis project before they have actually started the official part of the project. In our experience, a closer interaction between supervisor and student starting on the day of the first encounter helps to reduce the number of drop outs and keeps the students focused on their theses.

The patterns introduced in this pattern language can guide supervisors in such a close interaction. We started to write down these patterns for various reasons:

- After several years of experience in supervising students during their thesis work, certain patterns were becoming too obvious for us to be ignored.
- Some best practices we apply today would have saved us a lot of time in our early years as supervisors if we had been aware of them or been able to use them. And we regretfully notice that novice colleagues tend to make the same mistakes as we did when we first supervised thesis projects.
- Initially, we thought that there were already patterns for this subject. However, we were not able to spot articles discussing this issue.
- Some books on the subject, such as [6], give good advice, but do not cater to new developments such as agile methodologies. As many students' thesis projects develop rather into an expedition than into the manufacturing of a product, agile practices helped us a lot in supervising thesis projects.
- The integration of supporting computer technology (such as wikis, email, repositories) into the supervising process has changed further and improved the processes for us. We are not aware of any literature that captures how technology support interrelates with the social practices of thesis supervision.
- Finally, we think that a compact description in pattern form has more potential to be widely noticed than any book on the subject, even if it is as concise as [6].

Although these patterns are targeted at thesis supervisors, we think that they can also help students working on their final theses. The patterns can act as a guideline for both parties and help to make the expectations of supervisors and students more explicit. This has the advantage that students can adapt to the way how supervisors think that thesis projects should work. The patterns draw the picture of an ideal student who is responsive and makes her process transparent. But they also describe how an ideal supervisor should take care of the student. Thus, the patterns require a high level of discipline on both sides, and supervisors and students should be aware of the fact that both parties might fail to implement some of the patterns. In our experience this is not critical, as long as there is an open and honest communication culture. Neither students nor supervisors should close their eyes, but speak up when observing situations where one side fails to play their role.

We explicitly exclude supervising Ph.D. theses from our patterns for two reasons:

- As a Ph.D. student has to work much more independently, less guidance

should typically be necessary.

- None of us has enough experience in supervising Ph.D. theses.

This does not mean that some of these patterns cannot be used in Ph. D. supervision. However, we have no experience with the application of these patterns in Ph. D. theses. If you are a Ph. D. thesis supervisor, you may have a look at [3].

As noted before, we consider thesis projects to be instances of a blended learning setting. Consequently, the patterns of this pattern language are written as socio-technical patterns. Each pattern starts with a context description and a problem statement that summarizes the main reasons why the pattern should be used. After that, we list a set of forces that were considered in the pattern. We understand these forces as conflicting requirements in the interaction between supervisors and students. The goal of the pattern should be to change the socio-technical setting of the process in a way that the forces are less conflicting. In an ideal situation, the solution would remove the mentioned conflict between the forces.

The solution names social interaction between student and supervisor. After this, we discuss the design and use of technology that can support the social interaction between supervisor and student. In most cases, it is sufficient to employ standard technology including communication technology (telephone, e-mail or instant messaging systems) and shared information spaces like wikis or shared file systems (e.g., BSCW or Google Docs). In some cases, a tighter integration of technology can be needed, which is described as a design guideline for technology designers. Note that all patterns can also be implemented without any technology support.

2. The Pattern Language

This paper contains the following patterns:

- 2.1 FIRST ENCOUNTER: Your first meeting creates the basis for a trusting and efficient work relationship. Be thorough in defining the *formal* context and leave the details of the subject of the thesis for later.
- 2.2 PROJECT HEARTBEAT: Request status updates on a regular basis to ensure that the student is still participating in the project.
- 2.3 AGILE EXPOSÉ: Make the student write an exposé for the thesis and make the student update it based on your feedback until the task is well-defined for both the student and you.
- 2.4 EARLY OUTLINE: Let the student write and maintain an outline of the final thesis as soon as the scope of the project is well-defined.
- 2.5 STUDENT-MANAGED SCHEDULE: Ask the student to create a project schedule and ensure that the student updates the schedule when the work progress deviates from it.
- 2.6 DIARY: Propose that the student writes daily notes on her/his progress in a diary, so that ideas and decisions stay persistent throughout the project.
- 2.7 ADVISED LITERATURE RESEARCH: Let the student collect and reflect on literature in an interaction with you.
- 2.8 TEST THE WATERS: Identify the student's strengths and weaknesses by assigning tasks on a small scale. Upon completion, ask for the time needed, so that you learn about this student in particular and about students' performance in general.
- 2.9 EXPRESSIVE STUDENT: Ask the student to present the core of her/his research at different stages of the thesis project and on different levels of granularity also to other people than yourself.

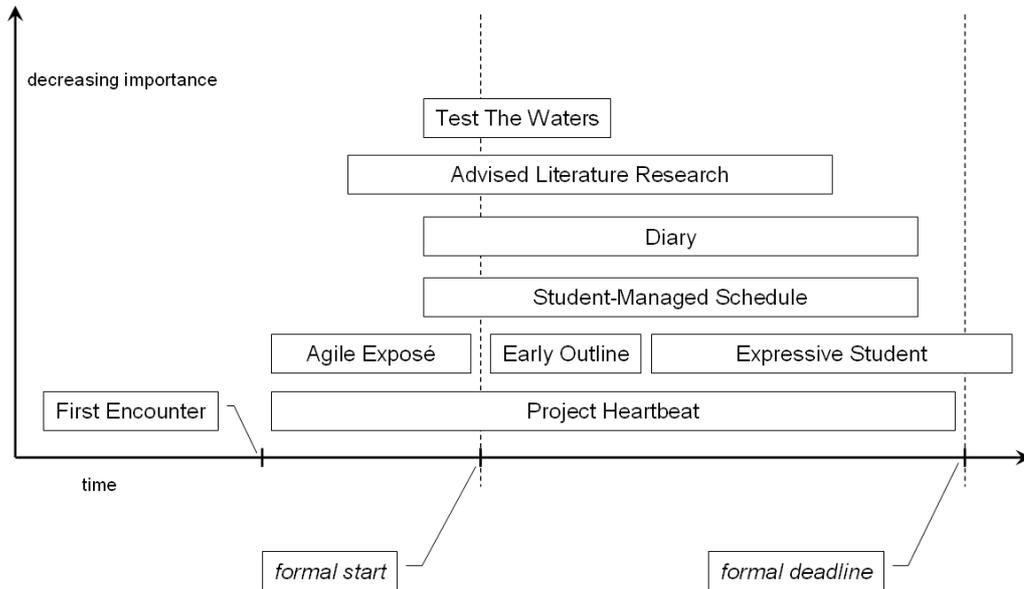


Figure 1: The patterns on a timeline

Figure 1 shows the patterns of this pattern language on a timeline. Any thesis project has a formal starting point and a formal deadline. These dates are typically enforced by official regulations of the educational institution. In the figure, the patterns are shown in relation to these points in time. For example, according to the figure, AGILE EXPOSÉ should be fully applied before the project is formally started. DIARY can be started at some point before the formal start and EXPRESSIVE STUDENT can be applied before and even after the formal deadline.

When selecting patterns for a concrete thesis project, we suggest you first select the patterns closer to the timeline since these patterns are more important than those shown at the top of the figure.

2.1 FIRST ENCOUNTER

Context: A student is looking for a subject for her/his thesis. You fulfill the formal prerequisites for being a supervisor. The student asks you if you would be willing to supervise her/his thesis.

Problem: You need to find out whether cooperation with the student can work out. If you do not clarify expectations upfront, there is too much room for misunderstandings and conflict.

Forces:

- You might not know the student very well, maybe only from one or two previous courses. Especially you might not know much about the student's abilities.
- The student might not know you too well, either. S/he might not know what exactly you expect from her/him.
- Procedures might not be clear if no formal framework for theses is applied in your institution.
- The topic should be tailored to the student's preferences and capabilities.
- Your additional workload of yet another thesis supervision should also pay off for yourself.

Solution: Meet the student to tell her/him how you handle thesis projects. Give as much information about your way of supervising as possible. Pass on this pattern language. Ask the student about her/his personal situation, including:

- What degree is the student aiming for (Bachelor, Diploma, Master's Degree)?
- In which program (e.g., Computer Science, IS) is the student aiming for a degree?
- When is the student planning to start working on the thesis?
- Are there any external formal or hard deadlines, e.g., exams, expecting a child, long-planned holidays?
- Is the student planning to work on the thesis full-time, part-time or at nights?
- What kind of degree is the student aiming for? Is s/he ambitious or just looking for some final thesis?
- What preferences does the student have with regard to helpful skills, such as programming, theory building, interviewing, or writing?

After the student got an impression of the formal context, ask how much time per week (in days) the student is willing to spend on the thesis. Based on the answer, calculate the earliest date you can think of for finishing the desired type of thesis (e.g., the student is willing to work three days a week. For a half-year full-time diploma thesis this means that the work will have to last for at least nine months!). Try to fit this with your personal context (e.g., you might prefer to get the final thesis in your semester break) and fix a deadline with the student.

Even though this might not be the actual formal deadline, having the time frame fixed gives both the student and you a good base for planning.

Technology Support: When agreeing on a date for the first encounter, you can ask the student to send you a short CV to learn more about her/his background. Together with a confirmation of the appointment, you can send out an agenda as well as a link to your personal thesis guidelines. These guidelines are a public document in which the general rules and assumptions for the supervision of thesis projects are shown. You may even consider passing this pattern language to the student.

In cases where you use a shared workspace system for supporting the interaction between you and the student, you should prepare the FIRST ENCOUNTER by cloning a template workspace that already contains information about structuring a thesis project.

Discussion: The first encounter helps to reach a mutual understanding of each other's goals and expectations. The questions stated in the solution can serve as a check list and ensure that all important information is exchanged.

Although it can work in some cases, we advise against starting a thesis project without an initial face-to-face meeting, even in a fully distributed setting like the FernUniversität in Hagen. The meeting helps to create a mutual understanding as well as an impression of the student (and the student will get an impression of you). See also "Face to Face before Working Remotely" in [5] where the authors recommend to have a face-to-face phase in the early days of a development project before individual sub-teams start working in remote locations. If you cannot arrange a face-to-face meeting, you should have the best possible meeting infrastructure in place for this meeting including at least high quality video and audio connections. In an ideal setting, you would also use shared whiteboards for creating hand-drawn figures and application sharing systems for looking at example systems together. But even then, we do not recommend a remote FIRST ENCOUNTER.

Related Patterns:

- 2.3 AGILE EXPOSÉ: Typically, the first task for the student after the initial meeting is to create a problem definition that captures her/his understanding of the thesis' goals.
- 2.5 STUDENT-MANAGED SCHEDULE: You can start discussing the cornerstones of a schedule during the FIRST ENCOUNTER.

2.2 PROJECT HEARTBEAT

Context: The student is working on the thesis.

Problem: To successfully finish the thesis project, the student has to keep up the pace. But it is hard to detect changes in the student's pace that make appropriate support and coaching necessary. The thesis eventually runs completely out of schedule.

Forces:

- The student is not co-located with you (e.g., is not working in your research group), so you have no casual or regular contact.
- Many external forces (workload, family-related issues) can hinder the student's progress in such a way that major rescheduling becomes necessary.
- The project can lose its momentum because the student needs more pressure from your side.
- The thesis might not be part of your own research agenda, so you have no intrinsic interest in its progress; without active input from the student the thesis shifts out of your focus.

Solution: Propose a social contract that forces the student to report the project's progress at least every 14 days. Ask the students to summarize the work and their insights since the last report. Whenever a report is overdue, remind the students of the violation of the social contract and propose a meeting where the future of the thesis work is discussed.

Technology Support: The student sends you an e-mail reporting on the latest progress. You store the latest mail in a thesis folder and mark this mail for tracking after 14 days. You frequently check the mail folder and contact those students who have violated the social contract.

An integrated system can even further improve the social process outlined by the pattern. The system can keep track of the last activity summary and prompt the students to update their activity summary in the agreed intervals. Both the individual student and you can see the date of the last report. In addition, you see an overview of due reports for all of your students.

Discussion: Project heartbeat is closely related to the ALIVENESS INDICATOR presented in [10]. To our experience, the 14 days period has shown to be an effective time span for not losing the mutual awareness. If the DIARY pattern is applied, the regular entries can be considered to be PROJECT HEARTBEAT. In such cases, an integrated groupware solution would keep track of the dates of the latest diary entries.

Related Patterns:

- 2.6 DIARY: The DIARY provides more information on the progress of the thesis. On the other hand, it requires additional efforts from the student. The PROJECT HEARTBEAT can thus be considered an automated and lightweight version of the DIARY. We consider PROJECT HEARTBEAT to be mandatory and DIARY to be desirable.

2.3 AGILE EXPOSÉ

Context: The student has expressed interest in a specific problem area. You are interested in specific results, like the creation of a software component, the analysis of usage data, or a literature overview of a specific field. Such results are valuable to you as a researcher and help you to gain new insights, e.g., in the context of your larger research agenda. The problem statement for the task has been discussed during the FIRST ENCOUNTER.

Problem: The student and you have different visions and goals for the result of the thesis project. If the goals are too different, the student will create a solution that does not meet the supervisor's expectations. This can result in a poor grade and unusable results.

Forces:

- You have identified an interesting problem, but you do not have an idea for a solution to the problem yet. Note that solution ideas can evolve out of discussions.
- You have a clear vision for the thesis, but you have failed to communicate it to the student during the FIRST ENCOUNTER (1).
- The more the student delves into the topic, the more aspects will s/he be able to contribute to the problem definition.
- The task should be challenging and scientifically relevant.
- The task should be tailored to the student's preferences and capabilities.
- You have to guarantee that the task is appropriate for a thesis.

Solution: Ask the student to summarize the plan for her/his thesis in her/his own words by writing an exposé. An exposé is a text of 2 to 6 pages length, describing the context, the problem, the approach to a solution (if appropriate) and a rough schedule for the actual work on the thesis. You comment on the exposé and ask the student to rewrite it until it embodies a shared understanding of the task. This process can take several iterations and thus several weeks. It is the *collective responsibility* of the student and you to reach such a written 'agreement' both are satisfied and comfortable with.

Technology Support: The supervisor creates an empty wiki page for the task description. At the end of the meeting, s/he asks the student to summarize her/his understanding of the task and to send the complete summary to the supervisor. Upon receiving the mail, the supervisor edits the wiki page and highlights points where s/he has a different understanding of the task. This is repeated until the supervisor sees no more differences.

More task oriented groupware applications can improve the coordination between student and supervisor. Typically, such systems provide explicit FLOOR CONTROL [10] for the document. After the student has finished the task summary, s/he passes the floor on to the supervisor who will get informed immediately. The supervisor can use SHARED ANNOTATIONS [10] for pointing out differences in understanding and pass the floor back to the student.

Discussion: An exposé should not be seen as a small version of the final thesis (sometimes students write their thesis text based on their exposé).

Instead, an exposé describes upfront what should be done, with a focus on the process, including a timeline with a description and an estimation of the necessary subtasks. The structure of the final thesis text can be very different from this (and typically is). After the student and you have agreed on a stable exposé, it does not need to be changed again. It can serve as a contract that defines the scope of the work.

Related Patterns:

- 2.9 EXPRESSIVE STUDENT: It is important that the exposé is written by the student. But while EXPRESSIVE STUDENT aims at the student's ability to convey the core idea of the thesis project to other people than you, this pattern focuses on the relationship and the mutual understanding between the student and you (the supervisor).
- 2.8 TEST THE WATERS: When writing the AGILE EXPOSÉ, you learn more about the student's writing skills. For the student it is a first test of writing a text that you must agree with.

2.4 EARLY OUTLINE

Context: The student has started to work on the thesis.

Problem: Students have difficulties to start the writing process, especially when they see a blank screen or an empty sheet of paper. They have very limited experience on structuring their ideas in a way that is suitable for a scientific thesis.

Forces:

- Students typically underestimate the time needed for writing the final thesis text.
- Often students have no prior experience with writing a larger document.

Solution: Ensure that the student creates an outline of the thesis directly after the scope of the thesis has been defined. Provide a prototypical thesis structure and ask the student to adapt the structure to her/his specific problem. Ask the students to add one paragraph explaining the intended content for each section in the outline.

A prototypical outline might look like this:

1. Introduction

This section motivates the problem that is solved in the thesis. It provides first explanations why the thesis is worth reading and explains its structure.

2. Problem Analysis

The goal of this section is to explain the background of the investigated problem. It explains why it is a problem and deduces a set of requirements that need to be fulfilled for finding an optimal solution. It may also point out conflicting requirements and request that the conflict is resolved. It may make sense to conclude this section with a table showing all requirements.

3. Existing / Other / Related Approaches

This section should contain a list of related approaches or solutions that could be applied for solving the problem and satisfying the requirements. Each approach should be summarized and discussed with respect to the requirements. At the end of this section, you should provide a summary of deficits of the state of the art.

4. Approach of the Thesis

Explain the concepts of your approach and show how you address the requirements. In cases where you build something that users should use (e.g., interactive software), it can be good to show how your solution is used.

5. Solution Details

Explain details of the solution. The description should be detailed enough to allow a peer researcher or practitioner to re-implement the solution. This section may also contain studies on how the solution has been used.

6. Evaluation

Reflect on the effectiveness of the solution. Show evidence, if possible. Evaluation can be done quantitatively or qualitatively, depending on the solution and the context.

7. Conclusions

The final section should serve three purposes: (1) To summarize the approach; (2) To compare the approach to the state of the art; and (3) To point at top directions of future research and development.

A. References

The outline should be a living document that should be updated regularly during the thesis project.

Technology Support: Create a wiki page for a prototypical outline. Copy this page after the student has created the problem statement and send it to the student with a request for adapting the outline. Periodically ask the student if the outline is still aligned with the current thesis.

Discussion: Sharing the thesis outline may result in a new pair of conflicting forces: The outline should provide a high-level overview of the thesis, while the thesis itself contains the real content. Changes in the outline affect the document and vice versa. All current text processing systems thus automate the process of outline creation. However, if only one part is modeled as a shared document, this synchronization may be more difficult.

Related Patterns:

- 2.5 STUDENT-MANAGED SCHEDULE: The schedule explains how and in which order the different parts of the outline will be filled. Both schedule and outline help to structure the student's work better.
- 2.3 AGILE EXPOSÉ: While the exposé describes what *should be* done, together with a first version of a schedule, the outline is a mini-version of the final thesis text und should describe what *is being* done.

2.5 STUDENT-MANAGED SCHEDULE

Context: The student and you have agreed on a problem statement and the student is about to start working on the thesis.

Problem: Students are independently managing their time. However, they often lack experience in planning a long-term project such as a thesis. If this management is done in an unstructured way, students overlook critical deadlines. As a result, in most cases the final phase of a thesis project is accompanied by a high level of stress and may result in a quality decrease.

Forces:

- It is hard to predict the future, especially in a research project. Examples of common pitfalls are that
 - the student underestimates the time needed for writing the final text;
 - personal problems or the student's job suddenly require more time than expected;
- in order to finish the project on time, the student needs a plan;
- the student is not used to making and following a plan;
- the student is not aware of (potential) upcoming problems;
- you as a supervisor are not aware of problems in the student's progress.
- Consequently, you fail to intervene or help the student when help is required.
- The student is not happy with the progress but fears to discuss problems with you since this might lower the final grade.

Solution: Ask the student to create and maintain a schedule for the thesis project and ensure that s/he discusses it with you. Both parties agree on a set of milestones where the student presents intermediate results to you. Think about the deliverables that have to be completed at the end of the thesis project and estimate roughly how long it would take to finish each deliverable. Remain on a coarse level of detail (e.g., tasks lasting for approx. one week). You renegotiate milestones if the student was unable to complete the required steps for a milestone. The schedule should be updated regularly.

Technology Support: You create a skeleton wiki page that includes the typical milestones for the thesis project. Before the student starts working on her/his thesis, s/he adapts the schedule to her/his needs and fixes dates and content for the milestones. You approve the schedule, e.g., by e-mail. Shortly before a milestone, the student informs the supervisor by mail about the current status of the project and arranges a presentation date for the milestone. Schedule updates are also negotiated by e-mail. Finished tasks are marked in the schedule wiki page.

You can ease the process of schedule creation and maintenance by integrating scheduling support in the e-learning system. Instead of thinking about concrete dates, the student estimates the required time for each task and defines the sequence of tasks. Afterwards the system creates a schedule that is visible to

both the supervisor and the student. Students are informed about approaching deadlines, and the supervisor is reminded of missed deadlines. This ensures that there is a high awareness of tasks that are overdue. When all tasks for a specific milestone have been done, the system automatically arranges a review meeting where you discuss the milestone.

Discussion: The first draft of a schedule can be taken from the AGILE EXPOSÉ.

The schedule defines criteria by which the student's progress can be evaluated. In this context, it can serve as the source of an INSTRUCTOR EVALUATION [7], a pattern that points out that the instructor should comment on the student's achievements. The main deficit of the INSTRUCTOR EVALUATION pattern is that it does not explicitly focus on the underlying social interaction. Several systems support project management in a similar way. However, most e-learning environments do not support task planning.

The student should not add too much detail to the schedule. This is the reason why we would not suggest the use of project-management systems such as MS-Project®. These systems tend to create a vision of safety although the research project as such still has a high level of uncertainty.

Related Patterns:

- 2.6 DIARY: The schedule should be reflected in the DIARY as soon as the plan is realized.
- 2.2 PROJECT HEARTBEAT: An alternative way of tracking the student's progress is to let her/him send regular messages to you. If these are the only record, the student should keep these messages as a DIARY equivalent.

2.6 DIARY

Context: The student is working on the thesis. The thesis involves design, experimentation and tests with different design alternatives.

Problem: The thesis project requires a long research and learning process. The student explores the state of the art, creates hypotheses and experiments to verify the hypotheses. The deeper the student delves into the work, the less reflection takes place. **Important insights and ideas may thus get lost during the project. In addition, in many cases the supervisor learns too late about problems and thus is unable to provide suggestions for improvements at the right time.**

Forces:

- Good ideas and new insights materialize during a thesis project, and not all of them can be implemented.
- The student forgets ideas and insights that s/he has not written down.

Solution: Ask the student to create a diary that documents the thesis project activities. The diary serves as a knowledge repository for all thoughts and insights, so that they will not be lost when the final thesis writing takes place. The diary or excerpts of it should be shared between you and the student at least. Frequently read the diary and see if the student ventures in the wrong direction. If needed, offer help, so that the student gets back on track.

Technology Support: The easiest way to implement a diary is to write it as a shared wiki page. However, student and supervisor have to agree on visibility levels which not all wikis support. In cases where privacy is an issue, the diary can also be created as a restricted wiki.

Further integration can link the diary writing activities to the student's workplace: Students log into the system when they start working for their thesis. Before beginning the work, they summarize their plan for the day. In the process of logging out, the system prompts them for a sentence telling what they have achieved this day. The summary is stored in the diary system which allows the student and the supervisor to browse all daily summaries of the thesis project. If there are unsolved problems, the student can mark these as action items for the next working session. Note that the system should allow students to mark entries as private, so that the supervisor cannot see these entries.

Discussion: Derntl [7] also describes a DIARY pattern. Due to the pattern structure used by Derntl, the problem is not clearly stated. In addition, the staged solution description makes it easier to apply the DIARY pattern in different e-learning systems. BLOGs are often used to support the collaborative creation of a diary in e-learning contexts. Moodle, e.g., offers students and teachers to co-construct a so-called journal that fills the role of the DIARY.

It can also be helpful for you to keep your own diary of the meetings with the student (a *supervisor diary*). As you typically supervise more than one student, this will help you to remember what has happened so far. This is especially useful if the student is not applying this pattern or if you have no access to the student's diary.

Related Patterns:

- 2.2 Project Heartbeat also suggests to provide periodic summaries of the progress made. As said before, a DIARY can replace the PROJECT HEARTBEAT under certain circumstances, but without a DIARY there should a least be an application of PROJECT HEARTBEAT.
- 2.5 STUDENT-MANAGED SCHEDULE: Whenever the student enters a note regarding a finished task in the DIARY, s/he should re-estimate how this helped her/him to finish schedule tasks.
- 2.7 ADVISED LITERATURE RESEARCH is an alternative for documenting and exchanging insights from literature studies.

2.7 ADVISED LITERATURE RESEARCH

Context: The student is working on the thesis.

Problem: Students need to evaluate research literature in order to relate their ideas to the state of the art. But in their previous studies, students were rarely confronted with research literature. Instead, they received pedagogically enhanced material that clearly stated questions, methods and results. **Without a solid base of references, the thesis might not be scientifically sound enough and thus you would have to give it a poor grade.**

Forces:

- Other people’s results can be very inspiring and helpful for the thesis project.
- Working with literature is not as interesting as building a design artifact, such as a running software system.
- Students, especially in engineering disciplines, tend to think that literature references are just a formal detail belonging only in the final thesis text.
- Sometimes it is not easy to find relevant literature for a specific topic.
- The students expect you to provide them with relevant references.

Solution: Ask the student to fill a literature pool. Let her/him search, summarize and comment the literature. Make sure you obtain regular access to the literature pool and comment on the student's summaries. This is especially necessary if the student frequently uses “unsound” sources, such as “XX in 21 Days for Dummies” or Wikipedia articles authored by hobbyists that have not yet been reviewed by experts. Sometimes it is also helpful to get a second opinion from a colleague on the literature pool for the specific problem.

Technology Support: Use a wiki to manage the literature summaries. In cases where the wiki supports page templates, you should create a template that contains all required fields for the literature summary as well as the bibliographic data. After the student created a literature summary page, s/he shall send the URL of the new page to you, so you can comment the page.

Discussion: Systems like Connotea (<http://www.connotea.org>) or WIKINDX (<http://wikindx.sourceforge.net/>) support groups of students in collecting literature summaries.

This pattern is closely related to the READ, READ, READ pattern [3] which emphasizes the process of creating a literature summary.

Related Patterns:

- 2.6 DIARY: ADVISED LITERATURE RESEARCH as well as DIARY can help to document the student’s progress.

2.8 TEST THE WATERS

Context: The student is working on the thesis project and manages her/his own schedule.

Problem: Thesis projects, as most research-related endeavors, contain many uncertainties. Many different activities must be undertaken by the student, e.g., literature research, reading papers, conducting interviews, writing large portions of text, creating design prototypes or developing working software. **If the student has no experience with the tasks the thesis project requires, the estimation of a schedule becomes difficult for her/him and s/he may miss deadlines.** Furthermore, if you have a wrong impression of the student's abilities, you are in danger of expecting too much, which can result in a worse grade than necessary.

Forces:

- You have your own idea of how much time is needed for a specific subtask, but you do not know how long an average student needs.
- You have an idea of the amount of time needed by the average student, but do not know how much time the student involved in this particular thesis project will need.
- The final deadline of the thesis is fixed for formal reasons.
- Students often underestimate the time needed, especially for writing the final text of the thesis, feeling too comfortable while having still some months to go.

Solution: Let the student perform important activities on a small scale and make her/him measure the time that was actually needed to complete the task. Arrange to discuss these findings with the student, so you get an impression of the student's abilities. With such data you can learn about the student's time needs for this project, and you can tell other students how much time their predecessors needed.

If you are uncertain about the student's writing abilities, make her/him write part of a chapter and let her/him tell you the time s/he needed. If programming plays an important role in the thesis project, you can give the student a small assignment and document the time s/he needed for completing it.

Technology Support: The student regularly sends you e-mails to inform you about the time needed for different tasks in the project. You evaluate this data and compare it with that of other students.

Discussion: In this pattern, we project the planning mechanisms of agile methodologies (e.g., [1, 4]) onto thesis projects. The essence of agile planning is that you can only estimate well based on first hand experience.

The name TEST THE WATERS is taken from a similar pattern by Manns and Rising [8].

Related Patterns:

- 2.5 STUDENT-MANAGED SCHEDULE: A change in the work pace should result in an updated schedule.

2.9 EXPRESSIVE STUDENT

Context: The student is working on the thesis.

Problem: The student doesn't have a good idea of how to describe what s/he is doing. S/he has problems to find the appropriate level of detail and does not have a clear picture of which aspects should be put into or left out of the written thesis.

Forces:

- Many things happen during a thesis project that are necessary for the process, but not for the final thesis.
- If a student is deeply immersed in her/his subject, s/he can lose her/his view of the big picture.
- Other people than the student and you have a different opinion of the subject of the thesis; this is especially relevant if these people are also responsible for the final grade.

Solution: Let the student express the subject of the thesis, both orally and in written form as often as possible and on different levels of granularity.

Have a mandatory *defense* of the thesis at different stages of the project: possibly after the Exposé has been written, before the student starts to implement a solution, and at the end of the project.

The defense should clearly state:

- the importance of the problem;
- the current state-of-the-art;
- approaches that the student wants to take; and
- the expected contribution and benefits.

Invite members of your research group as well as peer students to the presentation. Also ensure that students who are currently beginning to work on their thesis have a chance to attend a defense by a student who is at a later stage.

Make the student prepare an *elevator talk*: Tell a knowledgeable stranger in 30 seconds (about the time being together in an elevator) what the core ideas of the thesis are. This talk can be updated regularly during the project.

Make the student write and present an *incremental synopsis*, i.e. the core ideas of the thesis

- in one sentence;
- in one paragraph; and
- on one page.

The extended version of the one-page synopsis should be the exposé, if one was written upfront. Again, the incremental synopsis can be updated regularly throughout the project.

Make several students work together on their theses (in a *thesis project*, as described, for example, in [9]). Make them exchange ideas and let them help each other (pair programming, feedback on exposés, etc.). This can be very helpful in large research groups.

Technology Support: The incremental synopsis can be stored as a dedicated wiki page. The student should be able to reproduce the content of the synopsis in different computer-mediated communication settings, such as electronic mail (explaining the thesis in one paragraph when, e.g., inviting a secondary advisor) or text-based chat tools.

Discussion: It is important that the student defends the current status of the project, not you. The defense can take place in front of the whole research group or just with the student, the advisor and the professor.

If the discussion went well, the student will be convinced that the topic is worth working on (and not just the advisor providing the topic). Otherwise, the audience will provide useful hints for adapting the topic. The student gets trained in defending project proposals (important both in academia and in the industry).

The concept of a defense is, e.g., practiced at Fraunhofer IGD in Darmstadt by Peter Tandler, who proposed to include it in this pattern language. It is quite well-established at many US universities.

Related Patterns:

- 2.3 AGILE EXPOSÉ: The exposé can be used as an input for the incremental synopsis.
- INTROVERT – EXTROVERT [2] discusses the difficulties some people have with presenting themselves, their ideas, and their project to others. The pattern provides hints for introverted students, so that they will present their work more self-confidently.

3. Conclusion

This paper is intended as a first step towards making the interaction between students and supervisors more reliable and transparent. Initially thought as a paper that describes the interaction between supervisor and student at a distance teaching university, we discovered large commonalities with the ways such projects are run at traditional universities. We also observed that – although we did not attend the same universities at any point in time – there is an implicit agreement on how successful thesis projects should look like. The same applies to failed thesis projects that were not well supervised.

With this paper, we hope to initiate a broader discussion on good practices for supervising thesis projects. More high-level theses as well as less drop outs would justify our work.

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4. References

- [1] Beck, K. and Andres, C. *Extreme Programming Explained - Embrace Change (2nd ed.)*. Addison-Wesley, 2004.
- [2] Bergin, J., Introvert - Extrovert. In *Proc. EuroPLoP '02*, UVK Konstanz, Irsee (Germany), 2002.
- [3] Bergin, J.: Patterns for the Doctoral Student, <http://pclc.pace.edu/~bergin/patterns/DoctoralPatterns.html>, last updated: July 15, 2002, (last visited June 10, 2008).
- [4] Cockburn, A. *Agile Software Development*. Addison-Wesley, Boston, 2002.
- [5] Coplien, J.O. and Harrison, N.B. *Organizational Patterns of Agile Software Development*. Prentice Hall International, 2004.
- [6] Deininger, M., Lichter, H., Ludewig, J. and Schneider, K. *Studien-Arbeiten (5. Aufl.)*. Vdf Zürich - B. G. Teubner, Stuttgart, 2005.
- [7] Derntl, M., *Patterns for Person-Centered e-Learning*, Ph. D. thesis, Faculty of Computer Science, University of Vienna, Vienna, 2005.
- [8] Manns, M.L. and Rising, L. *Fearless Change*. Pearson Education, Boston, MA, 2005.
- [9] Olsson, B., Berndtsson, M., Lundell, B. and Hansson, J., Running Research-Oriented Final Year Projects for CS and IS Students. In *Proc. ACM SIGCSE*, Reno (Nevada), 2003, 79-83.
- [10] Schümmer, T. and Lukosch, S. *Patterns for Computer-Mediated Interaction*. Wiley & Sons, 2007.