DESIGNING A LEARNING ENVIRONMENT FOR ISD: THE ROLE OF ENCOUNTERS AND EPISODES

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Abstract

Information Systems (IS) are playing an increasingly important role in every society through supporting more complex business processes that in turn demand more advanced Information Systems. Educating systems developers that are able to develop the more advanced ISs therefore becomes an important task. The focus of this paper is therefore how to design a learning environment for educating systems developers. The underlying research question is why a project based learning environment is a successful learning arena. We analyze and discuss findings from a case study of a learning environment in the third semester of a bachelor program. We use philosophical hermeneutics for a qualitative analysis of students’ reflection logs. The analysis of the data led to a special focus on the role of encounters and subsequent episodes in the students’ learning processes. One major finding was that the students report situations where encounters that were not planned, took place and had a positive influence on the reported learning. Another major finding was that episodes, the time span between the encounters, gave room for hermeneutic circles after the new understanding the students experienced in the encounters. Some implications of the findings are that episodes are important, not only as periods of time between the encounters but as a room for learning processes that took place after or between encounters, thus complementing the role of encounters as described in philosophical hermeneutics. The episodes made room for reflections and learning, and in turn, also opened for emerging encounters that challenged the pre-understanding of the students and in that way provided new learning opportunities. The students experienced and reported challenging situations that proved to ripen their competence not only in IS development but also in their possibilities for handling new and unexpected situations when working on development projects.

1. INTRODUCTION

How can a learning environment in a bachelor program be designed to achieve a best possible learning outcome competence wise for the students learning information systems development (ISD)? An information systems developer needs to be able to understand both the users of the system to be developed and to “model the real world as future users will see it” (Mathiassen et al, 2000, p. 45) so that the end users of the information system to-be-developed effectively can get support for their workflow and perform their business processes. It may be challenging to analyze and design a new and/or improved information system. However, the results of modeling activities may improve the developers’ understanding of the problem domain and of the application domain for the system. Such modeling requires that systems developers can analyze a given situation, and model and design a system accordingly. One way of providing learning opportunities for the students is to design a learning environment where the students will experience the consequences of their own work and further the work needed to handle these consequences through their own learning process.

Based on the authors’ previous theoretical work and experience (Nordheim and Omland, 2002), we used the ideas in that paper to design an actual learning environment for third semester Bachelor
students. The students are attending three mandatory courses in their 3rd semester; a systems analysis and design course, a database course and a programming course. Part of the design for learning is to let the students reflect on their experiences through attending the three courses. Inspired by the integration ladder (Harden, 2000) for integration of courses we probed the following research question: How can we as university lecturers design a learning environment to facilitate students learning information systems development? We published the results of our case study (Nordheim and Omland, 2016) and found through reexamining our data from that case study that a more specific research question emerged: How can we, in a hermeneutic sense, design encounters for better learning information systems development?

We suggest that philosophical hermeneutics (Gadamer, 1989) is a good theoretical background for analyzing how learning takes place in the context mentioned. Philosophical hermeneutics focus on the process of human understanding. We therefore apply hermeneutics to analyze how students reflect on their learning through analyzing the learning outcomes as logged in students’ own reflections.

In the following we present the theoretical basis for our study followed by a description of the research method used. The case is thereafter described, analyzed and the results discussed before the paper ends with a conclusion.

2. THEORETICAL PERSPECTIVES

Universities are designed for learning and for research. This paper concerns a learning environment where learning is understood as a relatively lasting change in behavior caused by acquiring new knowledge through experiences (Evenshaug and Hallen, 1975). Learning in this sense cause students to modify and/or reinforce their existing knowledge that lead to changes in students’ preferences, values, behaviors, and skills (Evenshaug and Hallen, 1975). This view of learning supports the objectives in a learning environment focusing on change. Learning therefore includes more than just acquiring factual and/or procedural knowledge. The students are expected to go through a process of reflecting on their experiences that may lead to changed behavior partly through reflecting on what to change, why to change it, and what consequences possible changes may have for their future behavior in ISD. Universities therefore should offer a learning environment so that students may achieve this kind of learning.

One way of designing learning environments is to integrate courses in the same semester to make the students experience how the content in the different courses relate to each other supplying a learning environment for better learning ISD. This includes learning through experiencing how the results of the students’ actions in one course influence their work in other courses. Examples of such learning environments are student projects that integrate material from three courses in mechanical engineering (Yoder et al., 2003), and software engineering projects across four courses (Sindre et al., 2003).

Harden (2000) suggested integration of courses from the lecturer’s perspective. We expanded Harden’s perspective and suggested that we could view the integration also from the students’ perspectives (Nordheim and Omland, 2002; 2016). We further suggested, theoretically, that it is possible to integrate courses on a relative low level of Harden’s integration ladder from the lecturers’ perspective and still let the students experience encounters that may lead to learning on a higher level of Harden’s learning ladder (Nordheim and Omland, 2016). One way of such integration may be by letting the students work with a common project in the different courses.

Course integration was a useful design for learning, as the students’ learning took place mainly through their experiences in a common cross-course project (Nordheim and Omland, 2016). Designing an integrated learning environment was found cost effective for the lecturers and useful for the students (Nordheim and Omland, 2016). The project helped the students reflect on connections between the courses and the project viewed as hermeneutic circles leading to increased understanding.
2.1. Hermeneutics

The focal point of hermeneutics is how understanding occurs. We base our hermeneutic perspective mainly on Gadamer’s (1989) philosophical hermeneutics. Originally developed to understand text, hermeneutics is now a recognized and accepted approach to achieve and explain understanding in general (Ricoeur, 1981). Our hermeneutic perspective is in line with previous interpretive research in IS based on hermeneutics, which has been premised primarily on Gadamer (e.g., Boland, 1989; Boland et al., 2010; Cole and Avison, 2007; Francis, 1994).

According to philosophical hermeneutics, the starting point of all understanding is one’s pre-understanding of a phenomenon (Gadamer, 1989). This pre-understanding is challenged by an encounter. An encounter is a situation where one meets a phenomenon that resists one’s prejudices. This encounter can be with e.g. a text, a person, a system or a software in this context. As one’s pre-understanding is challenged by an encounter, a process of modified understanding starts. This process which is the constitutive element of all understanding, is the hermeneutic circle. This circle applies to the full range of situations, actions, or texts we encounter in our everyday lives (Gadamer, 1989). It is a circular relationship between wholes and parts. The anticipation of meaning in which the whole is envisaged becomes actual understanding when the parts that are determined by the whole themselves, also determine this whole. Thus, the harmony of all the details with the whole is the criterion of correct understanding (Gadamer, 1989). We study how this perspective is driving the students in their reflections on their learning.

While Gadamer (1989) is careful not to refer to the hermeneutic circle as a formal methodology, the circle is a means to clarify the conditions under which understanding can occur. There are three such conditions: pre-understanding, prejudice, and horizons of understanding.

Pre-understanding is the general and provisional understanding one has of a phenomenon before studying the phenomenon. "Interpretation begins with fore-conceptions that are replaced by more suitable ones.” (Gadamer, 1989, p 267). Hence, one always has a pre-understanding that is a necessary part of the evolving understanding.

Pre-understanding is in turn based on prejudices. They determine how one at first sight understands a phenomenon. While continually attempting tentative understandings, one immediately assumes something, due to the prejudices. A prejudice is not negative; it is simply a precondition for understanding per se (Gadamer, 2001).

The complete set of a person’s prejudices is called the horizon of understanding. The horizon of understanding is the range of vision that includes everything that can be seen from a particular vantage point. This is related to what is called a hermeneutic situation, which means to be inside a situation. Project work in groups is therefore a hermeneutic situation. A situation represents a standpoint that limits the possibility of vision (Gadamer, 1989).

One’s horizon of understanding changes through encounters. Encounters may typically be with a text, a human being or with situations involving many elements which imply meetings between different horizons of understanding. An encounter implies a tension between different pre-understandings, prejudices and horizons of understanding. “In a conversation, when we have discovered the other person’s standpoint and horizon, his ideas become intelligible without our necessarily having to agree with him” (Gadamer, 1989, p. 303). In real life one often experiences that an encounter with another person may change one’s understanding of a phenomenon.

2.2 The relationship between learning and hermeneutics

We are concluding the theoretical discussion on hermeneutics with a reflection on how we understand the relationships between learning and hermeneutics in this research. Through an encounter either with a text or a situation that challenges his/her pre-understanding, a new understanding may emerge.
The changed understanding is not in itself learning, but an important prerequisite for the process that may lead to learning, understood as relative lasting changes in behavior.

Table 1 is a summary of key hermeneutic concepts, illustrated from data in this case study.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
<th>Illustrative example</th>
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<tbody>
<tr>
<td>Pre-understanding</td>
<td>A provisional understanding of a phenomenon before studying it. A necessary precondition for understanding.</td>
<td>“a focus on IS 200 is most important”</td>
</tr>
<tr>
<td>Prejudice</td>
<td>Our pre-understanding is based on our prejudices.</td>
<td>“the acceptance criteria for IS 202 are fairly low”</td>
</tr>
<tr>
<td>Horizon of understanding</td>
<td>The complete set of a person’s prejudices, here related to a phenomenon under study.</td>
<td>Getting an overview of the student project</td>
</tr>
<tr>
<td>Encounter</td>
<td>A situation where one meets a phenomenon that resists one’s pre-understanding</td>
<td>Project group meeting where discussions take place</td>
</tr>
<tr>
<td>Whole</td>
<td>A phenomenon that is being reflected on</td>
<td>A sprint or a mandatory assignment</td>
</tr>
<tr>
<td>Part</td>
<td>Details about the phenomenon reflected on.</td>
<td>A user story or a software package</td>
</tr>
<tr>
<td>Hermeneutic circle</td>
<td>The iteration between the whole and the parts. We understand the whole in terms of the parts, and the parts in terms of the whole. The harmony of all the details with the whole is the criterion of correct understanding.</td>
<td>“after two sprints, we realized that we should have appointed a scrum master”</td>
</tr>
</tbody>
</table>

2.3. Encounters and episodes

Encounters often takes place in an instance, a brief period of time. Even if new understanding occurs for a student through or shortly after an encounter, the new understanding does not necessarily mean that the student has learnt something in accordance with the definition of learning relative lasting change of behavior (Evenshaug and Hallen, 1975) we apply in this paper. Inspired by Robey and Newman’s (1996) application of a social process model to study ISD, we include their concept of episodes in our study. Robey and Newman (1996) follow a punctuated equilibrium model of change and distinguish between two types of events: episodes and encounters. Episodes are viewed as relatively lengthy periods of equilibrium, while encounters are shorter and serve as a punctuation between longer episodes (Robey and Newman, 1996). We consider their understanding of encounters between user and developers to be a subset of the more generic term used in hermeneutics (an encounter with a situation where one meets a phenomenon that resists one’s pre-understanding). We also consider an episode to be likely to include hermeneutic circles, i.e. the iteration between the whole and the parts in order to reconcile one’s pre-understanding with the phenomenon encountered.

We argue that even if the concept of encounters is a key to getting a new understanding, it may not be sufficient for learning. We therefore introduce episodes and relate episodes both to encounters and to learning. We thus argue for including episodes as one element to see if we can expand the hermeneutic concepts to suit better in a learning environment. In this paper, we use the understanding of episodes as events of ‘relatively lengthy periods of equilibrium’ (Robey and Newman, 1996, p. 33), giving room for learning after the new understanding from the encounters that have taken place and making room for experiences that, in turn, may lead to new encounters. If the students get new understanding from the encounters, the subsequent episodes may give room for the students to reflect and to encounter different challenges that may in turn extend their learning to other areas of ISD.
3. RESEARCH METHOD

An exploratory research method is suitable for studying learning when students experience an integrated environment for learning ISD. A case study approach (Yin, 2014) was chosen where data was gathered through the reflection reports that the students wrote during the semester. As interpretive research (Walsham, 2006), Klein and Myers’ (1999) principles for interpretive research have been followed, in particular principles No. 1, 2, 3, 4 and 6.

The data was analyzed using philosophical hermeneutics (Gadamer, 1989), including the concepts presented in Table 1. We used hermeneutics both as a tool for data analysis, and as a process for organizing the data analysis. Our pre-understanding is summed up in the case description in the introductory part of Chapter 4 and in section 4.1, Lecturers’ perspectives in the case. Figure 1 illustrates our pre-understanding in a hermeneutic sense of the case before starting the data analysis.

The data was analyzed using philosophical hermeneutics (Gadamer, 1989), including the concepts in Table 1. The design of the semester especially integrating the three courses with one common project opens for many possible encounters and episodes to take place. Encounters were therefore given special attention in the analysis process as part of the hermeneutic concepts. Furthermore, the data analysis was based on the concept of episodes (Robey and Newman, 1996) to get a more holistic understanding of the learning process and what the students reported having learnt.

Based on the above described analysis the findings were organized into encounters and episodes where encounters are concentrated events and episodes are time laps giving room for learning between encounters (Robey and Newman 1996).

The two authors were involved as lecturers in two of the three courses involved in the project. Thus, the authors were involved in designing the project and supervising work related to their courses. As lecturers following the students through the semester we observed changes. Obviously, we find that the students had learnt something. However, we hesitate to bring our observations as data for measuring the learning that took place and therefore concentrate our analysis on the data reported by the students. We measure learning based on the students self-reporting where they state that they learned something in one of the sprints in their Scrum process and that they therefore did something different in the following sprint. We further understand that using the students self-reporting on learning may be questioned. A formal evaluation of learning in addition to the students’ self-reporting in the cross-course project would have strengthened this study.

The data analysis was interpretive, and was performed on 38 students’ diaries, a total of 160 pages. The students did not get any hermeneutic thinking as input when writing the diaries. One of the authors initially analyzed the data, and the findings were discussed. The analysis started out by identifying important aspects of learning, as viewed by the students themselves. Then the students’ reflections were analyzed in terms of the hermeneutic concepts as presented in Table 1. In a first iteration of data analysis we coded the data according to hermeneutic concepts, mainly focusing on parts of the text. One result of the analysis is the examples of hermeneutic concepts found in the data (illustrative examples in Table 1). In a second iteration of data analysis we focused on the wholes which the students reflected on, before a third iteration focused on the parts of the text in the students’ diaries again. When we designed the semester, we did not consider episodes per se. When we started analyzing the reflection logs we found that before, between or after encounters the students reported that something happened that was not encounters and we found that these periods could be understood as episodes (Robey and Newman 1996). The following section presents results mainly from the second and third iteration of data analysis.

4. CASE DESCRIPTION AND CASE ANALYSIS

In the following we give an overview of the Bachelor program at the time of the data collection (cf. Table 2). The focus on ISD in the third semester is through three 10 ECTS courses: System analysis and design, Data modeling and database systems, and Object-oriented programming. Compared to another study of a cross-course software engineering project (Sindre et al., 2003), this project (i)
followed an iterative development using Scrum, (ii) the students were given the same assignment, but (iii) requirements had to be elicited as part of the IS-200 course, (iv) the students developed a client/server system with a relational database, and (v) used some pre-developed code. The outcome of the project was expected to be an Analysis, Design and Reflection report in IS-200 and implementation of a simple prototype including a database in IS-202. A more detailed description is given in Nordheim and Omland (2016).

<table>
<thead>
<tr>
<th>Table 2. IT and Information Systems Bachelor Program 2012 – IS</th>
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<tbody>
<tr>
<td>Semester 1st</td>
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<tr>
<td>2nd</td>
</tr>
<tr>
<td>3rd</td>
</tr>
<tr>
<td>4th</td>
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<tr>
<td>5th</td>
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<td>6th</td>
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In the following we first present the lecturers’ perspective for designing the learning environment for the semester, followed by case description and analysis of the case based on data from the students’ reflection logs.

4.1 The lecturers’ perspectives on the case

When designing the relationships between the courses in the third semester (cf. Table 2) we together with the lecturer in IS-202 aimed to provide the students with learning opportunities through experiencing wholes and parts when they developed their deliverables in the three courses.

The third semester was originally designed to give the students a broad view of ISD, of the competence in various disciplines that was required to successfully complete an ISD project, and provide an experience of using the results of their own work across courses. The students, however, generally focused separately on the deliverables and other products that they were required to hand in for each course. It seemed that they did not see, or at least did not reflect on the relationship between the courses and the importance of extending what they learned in one course to the other two courses, thereby not reaching the overall learning objectives for the semester. While the learning objectives for each course are made very clear to the students, the overall learning objectives for the whole semester were not clearly formulated by the lecturers. These findings led the lecturers to decide on the following measures redesigning the learning environment to rectify the unwanted situation:

1. We decided to let the students work on a common project that the content of each of the three courses should contribute to solve.
2. The semester was to start with a common introductory lecture where the semester’s learning objectives for all the courses were explained to the students. We would give a short briefing on the ISD process, and the lecturers responsible for each course would explain what their course was about, and how it contributed to the project.
3. In each course, we would emphasize that the learning from and products made in the other courses were important input, particularly in the programming course (IS-202) that focused entirely on the students as programmers working in project groups to implement the user stories developed in the systems analysis and design course (IS-200).
4. The project was run by using Scrum with one pre-sprint (lasting 2 weeks) and three formal sprints (3 weeks each). The aim of the pre-sprint was to get started, to produce user stories and
to suggest acceptance criteria for the user stories to be implemented. After the third sprint, the students could use two weeks to do the final adjustments to the IS and the project report.

Figure 1 is a simplified illustration of the lecturers’ perspective on the relationships between the 3 courses and their activities, expressed in hermeneutic terms illustrating the ISD project (on top) as a larger whole, with the project work within the three courses (below) as its parts. Each of the 3 courses (IS-200, IS-201 and IS-202) may be viewed as smaller wholes consisting of parts, such as: A = analysis, D = design, C = construction, T = testing. The courses then become the wholes with the different activities as parts. The common project constituted the main environment for encounters to resist the students’ pre-understanding. Encounters occurred led to a hermeneutic process with iterations between the whole and its parts, at different levels. Especially there are iterations between each course, constituting parts of the larger whole which was the ISD project. The common cross-course project is illustrated by the dotted rectangle.

Figure 1. Course integration as wholes and parts in a hermeneutic reflection.

In addition to the hermeneutic understanding of wholes and parts, we, as the lecturers, also planned activities for the students that we later came to understand, at least partly, as encounters after we started to analyze the reflection logs with an encounter lens.

We found in hindsight that we had planned two different types of encounters, generic encounters that could have been in any project and domain specific encounters that related especially to the domain of learning ISD (Table 3).

Our pre-understanding of the learning environment was that reflection is an important part of learning. We therefore made it compulsory for the students to write reflection logs. We gave the following information about the reflection logs in general terms: write about your experiences, what you think about them, what reflections you did, what you have learnt, and about what is positive and what is negative with the common cross-course project.

In this paper, we analyze the students’ reflections logs written when meeting the learning environment designed through the measures described. We found that the lecturers’ perspective as illustrated in Figure 1 was shared by the students. One student expresses this course integration as follows: in “This reflection log ...I have chosen to describe in general the three courses as they run in parallel through the semester and a common project is going to be the central core between each of the courses”.

Another student remarked that “These courses and the lecturers in the courses cooperate well, and the courses “interconnect”, which I think is very fascinating and good”.
Table 3. A classification of encounters

<table>
<thead>
<tr>
<th>Generic encounters (meetings)</th>
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</thead>
<tbody>
<tr>
<td>1. Group meetings with discussions, cooperation to complete mandatories</td>
</tr>
<tr>
<td>2. Lab help by student assistants</td>
</tr>
<tr>
<td>3. Meetings with lecturer: questions, feedback on hand-ins</td>
</tr>
<tr>
<td>4. Lectures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Domain specific encounters (tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. To make paper artifacts: event table, sequence diagram, user stories</td>
</tr>
<tr>
<td>6. To apply software, such as: make prototype, explore different classes, Java coding, use NetBeans, implement database</td>
</tr>
<tr>
<td>7. Scrum meetings, such as sprint reviews</td>
</tr>
</tbody>
</table>

4.2 Case description and analysis

The case description and analysis is based on a re-analyze of the data presented by Nordheim and Omland (2016) focused on the described encounters and episodes the data reported in the students’ reflection logs. The description is ordered and analyzed showing the students’ reflections on learning through encounters and episodes. Analyzing the data, we find that the students’ reflection logs typically are very compressed records of encounters and episodes. In the following we present some examples of how encounters and episodes interrelate.

One student reflected on encounters and episodes in the same course, i.e. IS-202. “Today I have struggled to find out how I make a function so that the users can create a module. There have been some challenges with NetBeans and error messages making the progress very slow”. The encounter makes the student aware of the problems with functions and the episode even though not so long provided room for the learning by using their new understanding through the learning process.

One student reports learning from one sprint to the next writing that “…. after two sprints, we maybe see that this ‘team scrum’ method without a boss and that all take responsibility is maybe not optimal and that maybe ‘scrum master’ had been more ideal for our group, but this is something we and I learn from. So, next time I will rather vote for having a ‘scrum master’”. The scrum meetings were commented and a student expressed as positive that the meetings “were an improvement from last sprint”. In a larger context parts of sprints function as encounters as they are specifically designed to organize the students’ work, and parts of sprints function as episodes.

An important part of the design of the learning environment was meetings as planned encounters for the students. One student reflected on meetings as means to complete assignments, but only when the students had prepared well in advance. “Preparation for meetings is key. I experienced that the assignments could be completed very efficiently if everyone is well prepared for meetings.” The meeting itself was designed as an encounter, but the time that was before the encounter, the episode, was used as preparation to the encounter and thus an important part of the learning environment. From the above data, we find that group work provides an arena for encounters and at the same time an arena for episodes where the new understanding the students get from encounters in their groups may be worked out through group activities in the following episodes.

One student commented that ‘Creating a first draft of the result and then look at it again after a few days from a different perspective helps to find problems in the draft or add new ideas that were not taken into consideration the first time.’ In this reflection, we see that an encounter (look at it again) comes after an episode (after a few days).

Another student reports that ‘I'm still working with user stories with more suggestions, going back and forth, struggling to find the best user stories. It's hard to choose when you have too many to choose from. Discussing with the group both user stories and acceptance criteria, get some help and then we decide what to include. Make priorities and justify the choice.’ In this reflection, we find that a number of encounters, ‘working with user stories’, are followed by episodes, ‘going back and forth’. This suggests hermeneutic circles as part of the process. Then several encounters follow, ‘Discussing
with the group both user stories and acceptance criteria’, and more encounters, ‘get some help and then we decide what to include’. After this, another episode follows, ‘Make priorities and justify the choice’.

Another student reflected: ‘We have started making the prototype, exchanging experiences with the group and watching tutorials on YouTube. Each member of the group has had some tasks and progress is good - although there are some unresolved questions and our mindset is not entirely unanimous when it comes to understanding some topics, but we find a solution by discussing together and finally make a conclusion.’ This reflection shows that an episode, ‘We have started making the prototype’, is followed by an encounter, ‘exchanging experiences with the group’, and a series of parallel episodes, ‘Each member of the group has had some tasks and progress is good’. After the episodes, the results from each of them are summed up in an encounter, ‘and finally make a conclusion’.

A last quote included in this section of description and analysis reads: ‘One of our user stories was discussed at the lecture as an example. As a consequence, before conversations with NN [the lecturer] we went through all our user stories and found that each of them had to be worked on and changed. It was hard to learn that our hand-in was generally bad, it was but good to get it corrected. We showed this to NN [the lecturer] and he was more pleased with our revised work.’ An encounter, ‘One of our user stories was discussed at the lecture’, is followed by episodes, ‘As a consequence, before conversations with NN [the lecturer] we went through all our user stories and found that each of them had to be worked on and changed’. These episodes illustrate a hermeneutic circle, iterating between the whole (user stories) and their parts. This hermeneutic circle appears to involve a mix of encounters and episodes.

Analyzing the data, reflections, we find the following relationships between encounters and episodes:

1. There are often episodes between the encounters, but not in all cases. A series of encounters may also occur.
2. There are often encounters between the episodes, but not in all cases. A series of episodes may also occur.
3. Hermeneutic circles appear to involve a mix of encounters and episodes between them.
4. Students’ reflection logs further reveal changes in students’ ways of working and in how they solve problems.

**4.3 The role of encounters and episodes in learning**

We have described and analyzed the students’ reflection logs from two different perspectives: encounters and episodes. Our findings are listed in four points in section 4.2. However, we found in our data that in addition to describing what happened related to encounters and episodes quite a few reflections reported changes in the way they worked. To deepen the analysis of encounters, episodes and learning we will continue our search in the reflection logs and describe findings in the logs from the different encounters designed by the lecturers (cf. Table 3).

In the sections 4.3.1 - 6 we use Table 3 to organize our presentation of the students’ reported data and reflections and some analysis with the main analysis presented in section 4.4.

**4.3.1. Encounters as group meetings**

Most encounters in this category were, obviously, at the group level, and here are some typical reflections from individual students. "... although there are some unanswered questions and our mindset is not completely unanimous when it comes to understanding some issues, but we find solution by discussing together and finally reaching conclusion». The student reports that new understanding happened in the group discussions that leads the students to make conclusions. The
understanding comes through the discussion, encounter, and then comes the learning when the student report that they were able to conclude.

One student reflected: "As a brief summary, I would like to mention that the group work has so far been a delight. I feel I’ve learned a lot of working in a tight group. It was a relatively tiring week with much to be done, but it also produced a good result." This reflection shows that the student found the encounter that took place working in a group useful and at the same time had episodes between encounters as discussions in the group. Some encounters were at an individual level: “Keep on meeting: Personal meetings are more effective than remote meetings via Skype and should be continued”.

4.3.2. Encounters with lab help by student assistants
These were important encounters in the students’ reflections, as this example shows:
"Got a breakthrough today at the lab. With the help of NN (teacher assistant), we finally got to both the module and the discussion solution in the IS-202. We have all been sitting together working on the IS-202 (problems) every day lately, without any considerable progress, so it's nice when something finally happens. This is a subject that you can work for a long time without getting anything at all until a sudden breakthrough occurs. This was such a day."

4.3.3. Encounters with lecturer
Some encounters were meetings with the lecturer, either to raise questions or to get feedback on work. "Today, the group met after the lecture to complete the compulsory assignment part 3 is-200. We had a brief chat with [NN] where we asked for help and guidance on some of the models we have made so far. We were advised how the navigation chart should look and how we can explain it in the best feasible way." “Today we have worked very efficiently with is-201. After a brief meeting with [NN], where we got some help getting started, it went a lot easier." The lectures were also reflected on as encounters that led to learning. "Lecture in IS-202. Begins to get more clarity in the programming section now."

4.3.4. Encounters with paper artifacts
A few encounters were reported as encounters with the task of creating paper artifacts. “This day was very constructive. We had a couple of good discussions about class diagrams, which produced a better result since everyone agreed.” "We specially struggled with event table, actor table and class diagram. After we made drawings and sketches of these as best we could, me and Trym continued to complete the last part of the work with these (diagrams). Again, we felt a little uncertain and contacted the German assistant teacher (do not remember the name). He was very nice and we had a good chat with him that made us understand more."

4.3.5. Encounters with software
There were quite a lot of encounters with software systems. “By setting up the web page in NetBeans using java and html in 202 one learns to link these together. ... The working method becomes a lot of trial and error, look at examples and back to trial and error. Learning to use beans where one stores information that is available when to be used when needed." "On Thursday a new problem emerged, rather a coordination problem. Everything works very well when we connected to databases located locally on our own machines, but this is a problem, because we are running the application using a
common database that is already created. What has happened now is that tables have been created in
the database that should not be there.”
An important finding is that these encounters with software often led to problems, which they needed
help to solve. Therefore, episodes followed these encounters. So, encounters with the software often
led to episodes where new encounters occurred. These were typically with the group, student
assistants or the lecturer. “In the IS-202 I have been at the lab and worked with sprint1. I was helped
by [NN] the one hour that made me understand much more than I already could." “The time had
come to link the code to the database. The days passed with error and trial. We eventually agree with
the lecturer and each other that we are currently are coding towards the local database. We spent
several hours in the lab with [NN] to get this up and running.”

4.3.6. Encounters with Scrum meetings
A few of the reported encounters were Scrum meetings. "... the first week was good. Here the group
worked well and communicated well. Product Backlog has proven to be a useful tool. Similarly, Daily
Scrum has proven to be." “One element to deal with that kind of problems in scrum are the daily
scrum where every developer answers the question “What have you done since last daily scrum?”,
“What will you do before the next daily scrum?” and “What obstacles are impeding your work?”.
“Through this element in a scrum projects every developer knows what the other developers are
doing and they can, if necessary, adjust the priorities of different tasks so that it is guaranteed that
none of the developers can't continue efficient working.”

4.4 Summary of findings
When we analyzed and summarized the findings we found that we did design the learning
environment by designing encounters, but we did not design any episodes. The analysis revealed that
episodes sometimes followed the designed encounters, sometimes preceded them, sometimes were
between encounters.

We further found that in addition to the designed encounter the students report situations that are to be
understood as encounters that were not designed by us. These encounters often happened because the
students in an episode experience something that changed their understanding of the situation. We
suggest that the episodes that precede or follow the designed encounters open a room for dynamics in
the learning environment where the students themselves take directions in the rooms opened for them.

We further found that the students report both a new understanding and learning sometimes without
distinguishing between the two and sometimes related to both encounters and episodes. Our analysis
still suggests that there are differences in the reality of these two reported words where learning needs
some kind of episodes to take place.

The role of episodes in learning can be viewed indirectly from the students’ reflections. They
comment on encounters, but not on the episodes. Summarizing the findings in short form gives the
following result:

1. The designed encounters functioned as expected
2. The importance of episodes was unexpected and episodes were not designed in the original
   learning environment design
3. The emerging encounters were found to be important for students and helped to create
dynamics in the learning environment
4. Hermeneutic circles appear to involve a mix of encounters and episodes between them.
5. The analysis of the data revealed relationships between understanding (hermeneutic) and learning (relative lasting change in behavior) from the students’ point of view

5. DISCUSSION

In this section, we will discuss our findings from our analysis and show how the findings expand the understanding of the encounters and episodes in designing a learning environment for better learning for ISD students.

We designed the third semester in a Bachelor program focusing on learning, i.e. the focus is on the student, not on the lecturers. This is comparable to another study (Sindre et al., 2003).

Based on the data in the study we found that students integrate their learning through the learning environment provided by the project. The project is a central part of the learning environment designed by the lecturers. However, important encounters took place that was not designed, and the episodes were found to be important for learning. We will therefore discuss the findings presented in the conclusion of chapter 4 and relate them to relevant literature.

Finding 1: The designed encounters function as expected

The reflections and the analysis of the reflections show that the students gained new understanding through experiences the encounters that was designed in the course. This finding is in line with hermeneutics (Gadamer, 1989) as may be expected. However, the design we used with one common project for three courses in the same semester gave the student more possibilities for expanding their understanding through numerous encounters as they in a very direct way had to experience the results of their own work in the different courses.

Finding 2: The importance of episodes

When we designed the semester, we did not consider episodes as a part of the design. Findings show that episodes before encounters proved important to prepare for new understanding in the encounters. Findings also show that episodes after encounters provided very important room for the students to try out their new understanding in practice, to actually learn techniques necessary for ISD. This finding strengthened Robey and Newman’s (1996) suggestion about episodes as part of understanding and learning in ISD.

Finding 3: The importance of emerging encounters

Unexpected encounters emerged in addition to the designed encounters. These encounters infused even more dynamics in the learning processes especially when the students became aware of them. The emerging encounters often appeared in the episodes where students were trying their new understanding from previous encounters in practice. The emerging encounters may give more specific meaning to encounters in a hermeneutic sense (Gadamer, 1989) as planned and emerging encounters are adding dynamics to the development.

Finding 4: Modifying the understanding of hermeneutic circles

Our findings are modifying our understanding of the hermeneutic circle (Gadamer, 1989), in that the circle especially needs to include more than just a new understanding that appears through encounters. Even if we found that encounters could follow other encounters directly, the new understanding need at some point of time to be tested in practice in order to lead to learning (as understood by Evenshaug and Hallen, 1975). As ISD includes both theoretical understanding and deploying of methods and techniques, encounters are in themselves not sufficient for learning ISD. Episodes are indeed part of the hermeneutic circle.
Finding 5: Relationships between understanding (hermeneutics) and learning (changed behavior)

The above findings are contributing to the major finding in this study, the relationship between understanding and learning in ISD. As we use a definition of learning that includes actual change in behavior a lexical learning does not suffice. Even if the students reported understanding and learning without distinguishing clearly between them the analysis shows that both encounters and episodes were necessary to show learning understood as relative lasting change in behavior (Evenshaug and Hallen, 1975).

The encounters were related to all three courses, and according to the students, the encounters constituted a driving force for learning. Episodes are important time laps between encounters where the students try out their new insights through encounters or meet situations where they are not able to handle the tasks present in the development leading to possible new encounters.

Compared to Robey and Newman’s (1996) view of episodes as relatively extended periods of equilibrium, we found that episodes are a useful concept to supplement hermeneutic analysis of learning processes.

We further found that Robey and Newman’s (1996) view of encounters as shorter punctuations is too narrow for our hermeneutic analysis. The wider and more generic hermeneutic concept of encounters (Gadamer, 1989) is needed.

We argue that even if the concept of encounters is a key to getting a new understanding, it did not explain all the aspects of learning that we found. From our case, we argue for including episodes in a hermeneutic analysis of a learning environment.

6. CONCLUSION

Returning to our research question: How can we, in a hermeneutic sense, design encounters for better learning information systems development?

Our main finding is that the learning environment established in the third semester in a bachelor study is leading to learning reported by the students. Understanding is an important prerequisite for learning, but does not suffice alone to lead to students changing their behaviour in ISD. Episodes give the necessary room for learning that leads to a changed behaviour in ISD.

The findings in this study may expand the hermeneutic circle to include not only encounters but also episodes, in order to explain learning. The hermeneutic circle may also include several emerging encounters that relies on the students’ own initiatives and actions in the development situation.

A practical contribution from this research is that lecturers that want to design a learning environment will benefit from explicitly considering the hermeneutic circle and include planned encounters, room for emerging encounters and design the episodes as rooms for reflection and action to improve learning for the students. A concrete advice is to set clear time slots for the main activities mentioned, and at the same time give project assignments that provide room for individual and group-wise discussions and suggested solutions providing room for students’ own learning processes.

A question for further research relates to why some students profited more from this learning environment than others. Parts of a possible answer may relate to how the students managed to work in groups. What if this kind of learning environment does not fit all kinds of students? Maybe the learning environment is more fitting for students reflecting on what they do, how they do it and what possible improvements may be within the various categories designed in the learning environment?

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