

Needed: A Different Approach to Prepare Information Technology Professionals

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Abstract

This paper reports from a pilot project where a number of traditional lectures in an introductory database oriented systems development course were replaced with interdisciplinary problem based learning sessions. The project is motivated by firstly, current trends in education and learning, and secondly, the role IT professionals play in shaping the future society. The problem based learning sessions were evaluated by surveying the students two months after the sessions took place. The paper reports on lessons learned and conclude that problem based learning is a highly viable approach to train IT professionals after considering some critical factors concerning introduction, implementation and motivating students.

Keywords: Problem based learning, information technology education

BRT Keywords: IA

Introduction

The modern educational system was developed roughly a hundred years ago to teach the students the skills necessary and the facts applicable to survive in the industrial society; facts that would be true and skills that would be useful throughout their entire life. The factory was the model of choice; all students learn the same way and should learn the same things; all should be at the same place at the same time; and facts are transmitted to the students and later measured through instruments like written exams. But things have changed: “Schools today are structured more for the industrial age ... problem is, those factory jobs don’t exist anymore” (Soloway 1993).

In the information society, preparing information technology (IT) professionals is a difficult task as the information age changes our lives. Some jobs are disappearing, others are emerging, while still others are being radically transformed by information technology. Not only will IT professionals live in a time of accelerating change, but more importantly, they will certainly contribute to this changing society with their knowledge about information technology, and the use of the same.

Scanning the literature, it is easy to see that current trends in pedagogics are very critical to traditional educational approaches in preparing students for the information society. For instance, firstly, that students will be ill served if educational institutions provide them with products or outcomes of enquiry without learning how actually to pursue enquiry (Margretson 1991); secondly, “Gaining automaticity in skill can free the mind for thoughtfulness” ... “But isolated skills are not the sequential building blocks that

lead to skilled problem solving and flexible complex thinking” (Hawkins 1993). Therefore, problem based learning (PBL) is advocated as viable pedagogical approach to provide information technology professionals to be, not only with the knowledge, but with the necessary tools to acquire new knowledge in the future.

The paper is organized as follows: In the first section I discuss the relation between teaching and learning. Then the foundation of problem based learning is briefly explained, followed by an outline of PBL in practice. The next section describes the PBL related material used in the pilot project and the participating students. “Analyzing the Survey” is the next section and all quotes in this section, where no source is given, are from surveying the students. Last, there is a discussion section with lessons learned, and some tentative conclusions.

Teaching or Learning?

It is not difficult to find critique of IT education practice. That is, the content taught, (Dahlbom and Mathiassen 1993) as well as more universal critique of the way it is taught (Pea 1993; Scardamalia and Bereiter 1993). Focusing on the latter in this paper, present day educational practice is questioned as the appropriate way to prepare IT professionals.

Without going in to a definition of either teaching or learning. Characterizing conceptions of curriculum we can apply a model involving the two archetypes of learning. First open learning, which builds on constructivism and social interaction (Harasim, Hiltz et al. 1995). Second closed teaching, which is rooted in an objectivist ideal of teaching and learning. In practice, these can best be viewed as opposite ends of a continuum. In that we call closed teaching it is assumed that students have to have the knowledge required to approach a problem before they can start on the problem, learning-before-doing; others mean that in open learning the knowledge arises from work on the problem, learning-by-doing (Ross 1991; Pea 1993). The former conception, closed teaching, lays itself open to what Popper has disparaged as ‘the bucket theory of the mind’ (Margretson 1991). The theory regards the mind of the learner, or the student, as an empty bucket which has to be filled with information before it can ‘know’ anything. Margretson (1991: 49) states that:

“It echoes the misleading model that has plagued education for centuries, the Lockean model of the mind as a tabula rasa waiting for the teacher to write on it. This implies a conception of teaching as little, or nothing, other than the transmission of information from active teacher to passive students.”

If we teach the students what to learn, we stimulate the desire to pass examination. Practicing open learning on the other hand, we teach the students how to learn. This way we stimulate their desire to inquiry and to learn more, the knowledge will come automatically. Open discovery and guided discovery are similar conceptions (Swanson, Case et al. 1991).

Discussing closed teaching and open learning there is a risk that more superlatives are used in characterizing the latter, and verbs with a slightly more negative tone in the former. This is the case in this paper. However, I do admit that closed teaching have qualities useful to fulfill certain purposes in high quality education. I also agree with

White and Purdom (1996) in that: “Much of the conflict about what should be done in education begins to make sense if we can understand the different mind-sets that generate the different proposals.” The lists below summarize the two end points.

Closed teaching

- Education is built as a rigid system with all students conforming to standard behavior expectations.
- Teachers are fount of all knowledge with all students quietly sitting in neat rows and all facing front.
- Students are uniform empty vessels to be filled with the same knowledge stuff.
- The teachers control the students by written exams where the students are to recall the newly acquired knowledge
- The teachers ask questions and expect the students to provide an immediate and correct answer.
- It is important to be time efficient. The teacher scans available material, filters out the important. This way the student do not have to waste time searching for information.
- Students work in isolation from each other gathering facts and memorizing models with little concern for their application.
- The building blocks of learning is structured facts, theory and models organized by the instructor.
- Teachers are experts responsible for organizing facts and information and transmission of the same to the students.
- All technological artifacts are used to improve information transmission.
- Activities take place on-line and face-to-face.

Open learning

- Education is a flexible system with a learning environment designed to meet each student’s abilities and needs.
- Teachers are facilitators who guide students in the knowledge. Students work in small clusters talking and planning together.
- Students are individuals with individual unique learning styles and interests.
- The teachers provide activities and materials that require students to transfer and combine skills learned.
- The teachers play the devil’s advocate by questioning, debating and challenging students’ responses.
- Finding, evaluating, systematizing and interpreting information is the purpose of learning activities and necessary skills.
- Students working cooperatively, gathering facts, and developing skills in decision making, problem solving, and information processing.
- The building blocks of learning is semi-structured real world problems.
- The teacher help students in setting personal goals, facilitate problem solving and critical thinking. But the students are responsible for their learning.
- Computing technology is to used to enhance open interaction, reflection, and

- communication.
- Asynchronous activities are central. Reflection is necessary to learn.

Problem Based Learning is Not Teaching

Problem based learning is NOT another way of teaching. It is a fundamentally different approach to learning than traditional teaching. Problem based learning represents a significant challenge to orthodox beliefs about education and learning (Margretson 1991). Central in PBL is the students' development of independent life-long learning and an inquisitive relation to professional as well as other dimensions of their life. Their own questions, formulations and conceptions of problems serve as the basis for learning. Looking ahead, it is also that "system developers need frameworks for thinking within which they can apply their knowledge to the challenges they face in their practice" (Dahlbom and Mathiassen 1993). Problem based learning can serve as the scaffolding for this Scaffolding is an educational term that describes this guidance and support, that the teacher provides to the learner (Watson 1996).

As PBL encourages open-minded, reflective, critical and active learning it can be a threat to the teachers who prefer passive students and maximum control over what is to be learned. In line with this, it is also a threat to those who conceive education as a one-way process of information transmission. But, to those who believe in mutual learning and feel comfortable with unpredictable outcome of activities, PBL is both morally and ethically correct as it pays respect to both students and teachers as individuals with knowledge, understanding, feelings and interests who come together in a shared learning process.

Problem based learning reflects the nature of knowledge, that is, knowledge is complex and changes as it is communicated among persons and communities. This is a threat to those who hold the conception of knowledge as information to be transferred. Also, it is a threat to those who restrict the notion of problem to small, atomic, single difficulties with a single optimal solution.

Adapting to, and participating in change and self-directed learning are composite competencies today. PBL as pedagogics and a methodology is expected to fulfill two distinct purposes (Engel 1991). Firstly, a method that will assist students in developing a set of competencies: adapting to and participating in change; dealing with problems, making reasoned decisions in unfamiliar situations; reasoning critically and creatively; adopting a more universal or holistic approach; practicing empathy, appreciating the other person's point of view; collaborating productively in groups or teams; and identifying own strengths and weaknesses and undertaking appropriate remediation, e.g., thorough continuing, self-directed learning.

Secondly, PBL is an approach of choice, because it is suitable for adult learning. Problem based learning is active learning through own questions and seeking the respective answers; it puts learning in the context in which the learning is to be applied in real-life situations; learning for understanding, is emphasized rather than recall of isolated facts, through appropriate opportunities to reflect on their education experiences; and learning becomes progressively less straightforward but more complex, as well as more challenging.

PBL in Practice

PBL in practice can take many forms. In this project the core of PBL has been the ‘base-group’ where the students work on a case in self-organized groups, or teams, of six to eight. Preceding the group work on the case, the instructor completes a regular lecture where central concepts to the case is introduced. Ideally, each base-group retires to a private seminar room.

Then, a teacher or other instructor facilitates the group process, but keeps a low profile not to interfere with the dynamics of the group. The work of the base-group is guided through the seven step model outlined below. The seven step model is divided in two phases and seven steps. The first phase, consists of two to three hours of concentrated discussion and work in the base-group. This phase is facilitated by the instructor. In the second phase, students work on their own. Of course they have access to the facilitator for any questions that may surface during this phase.

Introduction:

- Step 0: Concepts central to the session are introduced and made clear through a lecture.
- Phase 1:
- Step 1: The vignette is distributed and the students read through the case or the vignette. They make clear and explain concepts so everybody in the group understands the concepts used in the vignette or case.
- Step 2: Clearly define the problem or phenomenon the group wishes to work with.
- Step 3: Take stock of the ideas and opinions about the problem or phenomenon within the group. Divide the problem or phenomenon into sub-problems. Devote ten minutes of brainstorming for each problem found.
- Step 4: Systematize the brainstorming. Find relations, categorize and eliminate irrelevant sections of the brainstorming.
- Step 5: Frame questions to continue working with. Formulate concrete learning objectives.
- Phase 2:
- Step 6: Search and gather information and facts. Work with the data to form knowledge in relation to the learning objectives. Work individually or in groups.
- Step 7: Systematize the new knowledge. Validate the knowledge in relation to the problem. The knowledge should provide an understanding of the questions from step 5.

The Pilot Project

Four lectures in an undergraduate course in introduction to databases and systems development were modified according to PBL principles in the pilot project.

The Cases

In this form of PBL, a case can be anything between a single paragraph vignette, and a twenty page case study. Here, all cases were developed, from components of real case studies, incidents or anecdotes, by the author and aimed to fit the course as well as within the curriculum. The material the students worked with is summarized below.

1. User participation

A vast body of literature covers systems development, project management, and group dynamics. However, this literature does not mirror the complex reality of professional practice. The objective of this first session is to increase the understanding of problems related to the relation between the users and the experts in a systems development context. The students are expected: to understand the difference between user participation, participatory design, and expert design; and to discuss possible problems in systems development teams and how to deal with these problems. Below is short dialog between an IT expert and a user.

The new computer based surveillance system is installed at the industrial plant and the project is about to finish:

The security guard — “I will not use the new computer system. It is way too hard to use, and I am sure some manager is using the system to monitor us and our work. Nobody asked me about the need for any computer system. I am sure all of my colleagues agree on this.”

The project manager — “We did ask you about your preferences for the new system: You did have time to read through the system specification before we started programming. I can’t understand, what’s your problem.”

2. Method, methodology, or not?

A crucial condition for designing and implementing a high quality computer system is a well working project team. The team needs to explicitly coordinate different tasks and activities. A method or methodology is commonly used for this purpose. The objective of this session is that the student should: understand the difference between method and methodology; and discuss problems and situations that are likely to appear in the first project they will participate in.

A new computer system is to be developed at a large company. The eight person project team is gathered for the first meeting. Their experience of IT projects varies and none of them has participated in the development of a new system over the last three years. Kerstin from customer service is appointed project manager, and Gösta from the computer department as second in charge. Kent is the youngest in the team and a newly graduate from a four year Informatics program. First on the agenda was how to organize the work.

Kerstin— “First of all we need to choose a method. This is a crucial decision for the eventual success of the project. Also, management requires us to document the work thoroughly.”

Gösta— Method? I have never needed a method before. I believe that we all are experienced, and do not need some red tape tampering our work. I have worked with computers for more than 20 years.”

Kent— “This is my first project ever and I would like to follow a method. At the university, we did come across a number of methods. Maybe we could use one of those?”

Gösta— “Kent, listen to me. You have probably learned a lot of things at school. But this is reality.”

Maria— “Why make such a big fuzz about it. Let us pick a method to satisfy management.”

3. Local or central databases?

Storage of data can be distributed throughout an organization. The objective of this session is that the students should: understand the difference between locally and centrally stored data; discuss and understand advantages and disadvantages with each strategy; and discuss how to reach a proper balance between the strategies.

At a meeting, hospital management discuss IS/IT strategy. The matter under discussion is the new patient data system and whether data about patients should be stored locally at each clinic, or centrally at the computer department. A full day is devoted to this matter.

CIO of the hospital— “Obviously, data about patients must be stored in a central facility and managed by computing experts. This is necessary to guarantee security and integrity of the sensitive information. Information in the hands of the wrong people might be catastrophic. A central database is the only alternative and my department have the right knowledge and experience for this.”

Senior physician of psychiatry— “From my opinion, information must be stored locally. To me, responsibility of the patient includes the responsibility of the information. And psychiatric information is of no interest to others than us. Why should the information be stored anywhere else than with us, it is ours.”

Professor of social medicine— “I disagree. We use a lot of psychiatric data in our research. What you call your data is very valuable to us. That is true for all patient data within the whole hospital and I think I speak for many other departments.”

4. Escalation situations

The fourth case was slightly different from the three first. Here the students faced a case about a systems development project plagued with problems. The students are guided through three years of the project which experience deeper and deeper problems. The question whether to continue or abandon the project is surfaced constantly, but the project is always continued. Finally, the base-group is faced with the question; continue or abandon the project?

The objective of this session is to introduce the students to a common phenomenon in many projects, and especially IT projects, namely escalation situations. These are situations where people have continued commitment to a course of action despite information suggesting that the course of action is failing (Keil 1995).

The Learners

To collect feedback from the participants I used a survey. Eighty-four students were enrolled in the ten week long full time course part of the foundation year of a four year program. The foundation year consists of four partly integrated courses. Most of the

students had approximately six months of university education experience.

The four PBL oriented lectures were completely voluntarily and involved no extra credits. No formal data of participants were recorded at the sessions. Approximately forty-five students attended each of the four sessions. Two months after the course, the students were approached via e-mail. The reason to wait was to give the students an opportunity to reflect on their experiences. Three open ended questions and a control question were asked in the mail. Forty-four students answered the survey. Getting the answers in required three e-mails one week apart. I did not change the tone of voice in the succeeding e-mail. The following text was included in all e-mails sent to all the students:

“During this spring, problem based learning (PBL) was used as an alternative learning model. To most of you this was a new experience. Two months has passed and I assume that you’ve had the time to reflect on whether PBL is a viable way of learning. I appreciate if you take a moment and answer the following questions:

- What is your opinion about the PBL lectures?
- Comparing PBL with other lectures. What is the biggest difference?
- Which of the session [1-4 above] do you remember most? Why?
- How many PBL sessions did you attend?”

Analyzing the Survey

The dangers and bias with this type of survey is well known. Only half of the students responded to the survey but my feeling is that the sample give a fairly accurate view of all the students. Analyzing the survey I find it useful to deploy three dimensions identified by Norman and Spohrer (1996): engagement, effectiveness, and viability. According to them, engagement is the factor that can make more of a difference between success of failure than other factors. And they continue, one of the major themes of PBL is to use the problem as the primary motivation force. Students learn best when engrossed in the problem on hand and that students are engaged is rather easy to observe. The other two factors are more difficult to assess and certainly to measure. In the following section the students speak out about PBL.

What is your opinion about the PBL lectures?

Seventy five percent of the students agreed that PBL is a viable approach in preparing them for their professional life. Twenty one percent had mixed feelings, and four percent do not believe that PBL is a feasible approach. Analyzing the responses to the question, five categories of answers appears.

First, it is obvious that PBL is new to most of the students. “You get to think yourself” was a spontaneous comment from several of them. Obviously the closed teaching paradigm is imprinted in many students. Moreover, “PBL felt like a completely new way of working at lectures” and “This was completely different from any other form of lecture I have been to,” whereas only one student had previous experience as “this is the way we worked in high-school.” Most of the students agree that “the sessions were very good, but also very frustrating in the beginning, before I understood the principles behind PBL.” This is “certainly an element of future education, but we need more practice, and we need more facilitation.”

Second, PBL is a viable way of learning according to the survey. “PBL raise questions rather than give you answers” and “This is learning for life and not for the exam” are examples that speaks for themselves. The relation to, and to some extent, applicability of PBL, in the real world were also a common observation, such as: “We worked with cases that are difficult to learn about by just reading about them, the cases gave us a better picture of real life. You had to (try to) experience the situation in order to understand it.” The importance of making the objectives and the central concepts clear is also noticed: “These were the occasions when I learned most. Participating actively and putting theory into practice, this way the knowledge will last, but the preceding lecture could have been more focused on the cases than they were.”

Third, PBL is demanding according to the students as the outcome of the group work is up to them: “PBL is what you want it to be” and “Some of the sessions were better and more interesting, of course it depends on yourself.” That the students are aware of their responsibility for their own learning is apparent: “PBL require that you are mature to a certain extent, as well as the desire to learn” and “PBL makes you more responsible for your learning.” One student wrote that “the knowledge might be harder to acquire, but I am sure it stays longer.”

Fourth, it is difficult to re-learn if previous experience of education is mainly with close teaching. Structuring a discussion concerning complex issues and problems was difficult as “same problems were constantly discussed in the groups.” That common sense will get you to a certain point was not obvious to some: “As you do not have any real experience , you might not understand anything, maybe afterwards.” It is also clear that some students did not understand the objectives with PBL. “Coming straight from high-school you don’t have the experience to discuss these problems” shows that the principles of PBL were not fully understood. That is, common sense and group discussion will get the group to a certain point where the participants understand that they have to find information and knowledge from external resources, e.g., the literature.

Fifth, PBL is also problematic according to some of the respondents. “The sessions were a disappointment since I had expected a lot more technical and hands-on in this course.” Others were less humble: “The first two classes were rubbish, the time would have been better invested in reading the text book.” How the PBL sessions were related to the course and the curriculum was not clear to a handful of students as they commented “More databases” and “How is this related to databases?” A few students were skeptic to work together with others: “I do not trust the group to perform a good job, so I rather work alone.” There are also students who felt that the sessions involved too much control: “When we got the case and ‘Objectives of the session’ was written on the paper. I lost the interest and think this is bogus. However, a change in current system is needed, so any approach that discard cramming is welcome, but this did not suit me.”

Problem based learning is a viable way of learning according to most of the students participating in the survey. However, it is apparent that: “more introduction is needed as well as mandatory production of a report or similar” and an arena for discussion and feedback as many students “missed class discussion after the session.” However, to be effective in their learning process, the students need to work with the problems according to the model before a general class discussion. This way the students have the opportunity to reflect on their new knowledge.

Comparing PBL with other lectures, what is the biggest difference?

The main difference recognized by the students were that in PBL you, as a student, have to be more active: "Compared to traditional lectures you are active." Or in other words: "Being physically present and mentally absent was difficult." To many students, PBL were "active sessions for those who wanted. If you are engaged, you get a lot back."

Most of the students found PBL sessions to engage, if not all, but more students than other activities. "More participation of the students, in other lectures are only a few students really participating." Other students found that: "In the group, everybody were engaged. Searching information and argue for or against it, not only find and deliver an answer or a definition without debate and reflection." The relation to traditional lectures is well formulated in comments such as: "You get only a little information, with regular lectures you get everything served." The satisfaction of discovery was obvious: "You feel like you are discovering the knowledge, if not self, but together with the other in the group" and then he adds "which is actually what happens!"

PBL makes it possible for cases to come alive and connect with student's own experiences in life far more than ever be possible in a traditional lecture. "It is closer to reality than working with the literature and sitting through regular lectures" and "Here I can imagine real situations and understand the problems." The relation to course material was also pointed out: "It feels like it is closer to reality. Text books and traditional lectures cover how systems design and development should be performed, there is nothing about all the problems you will meet during the course of a real project."

PBL inspired to more independent work: "That I as a student can penetrate a problem and decide, individually or in the group, what the problem really is, and which aspect I would like to know more about. This way I got involved emotionally in some of the discussions, which helped me to understand." Others were insecure, but got "the opportunity to find my own standpoint." The closed teaching thinking is in attention again: "I can be creative, there are no definite answers." And that "brainstorming tended to include more aspects than if only the teacher suggest and present the standard aspects." Some students recognized the advantages, but seems to prefer the traditional format: "The biggest difference was that I had to be more active during class, which is good. But I prefer to get more theories and facts presented by the teacher during class, then I can practice myself."

One interesting observation is that many students were somewhat uncomfortable and felt that: "It is difficult to know what you have learned" and "We were insecure when we decided whether to continue discussion or to move on." A viable way to find out if the student have learned anything is maybe as Scardamalia and Bereiter (1993) found out in an interview asking a 5th grader in the CSILE project (Computer Supported Intentional Learning Environments. <http://csile.oise.on.ca>). The student replies:

"I think I can tell if I've learned something when I'm able to form substantial theories that seem to fit in with the information I've already got; so it is not necessarily that I have everything, that I have all information, but that I'm able to piece things in that makes sense and then to form theories on the questions that would all fit together" (Scardamalia: 38).

Most students find PBL as a viable alternative to other lectures, or even stronger: "PBL is an excellent alternative. The current cramming is with no doubt completely out of date."

Which of the sessions do you remember most?

Almost all of the respondents could explicitly pin point one of the sessions. The two most mentioned are 'Local or central databases?' and 'Escalation situations.' As one student articulated: "the one about escalation. Some of people in the group could not accept that a problem can be more complex than that a final solution could be presented within two minutes. This was interesting, but also frightening."

The first session, user participation, was the first time most of the students experienced PBL. One student wrote: "The first lecture, because this was something completely new. But I think I learned more in some of the other sessions."

How many sessions did you attend?

In the control question, seventy five percent of the students answering the survey attended three or four of the sessions. "All but one, I think?" is also a common answer from the students. This show that some students did not experience any difference between the regular lectures and the PBL lectures. And of course, "All, I usually attend everything, there might be something that I can learn."

Lessons Learned

Several important lessons have been learned from the four PBL enhanced lectures. As this was a new experience for most of the students, and certainly for me, some problems surfaced and some mistakes were made. This section describes the lessons learned.

Firstly, a thorough introduction to problem based learning as a method and a pedagogy is vital to reach success. The survey as well as my own reflections show that the introduction was too brief to reach all the students. More emphasis on the principles as well as the practical work is a requisite to get the students motivated. Some of the students had expected a more technically focused course, and "was irritated that the course dealt that much with softer issues." Therefore the overall objective of the course and how the database fits in to the course must be made very clear to avoid things such as: "Even if the softer issues are the most interesting to me, I got disappointed since I had expected the course to deal with databases in a more specific way."

Secondly, incentives are necessary to motivate the students. Unfortunately, it is somewhat naive to think that the students would find the sessions themselves as valuable activities. That the opportunity to interact with peers on problems is motivating enough to them. The importance of incentives is recognized by Hiltz (1997). Others postulate that assessment must be an integral part of the PBL approach (Ma 1996). Incentives and embedded assessment will be a central design issue in the future work.

Thirdly, coupled with the above is the possibility of complementing the model with an eight step. This step should involve the authoring of a report or a PM that should be reviewed by the instructor, an other base-group, peer review, or an external reviewer. The intention to focus on the learning process in PBL can be enhanced by having to deliver a tangible product. This step is advocated by some PBL practitioners, but regarded as a misleading, and even destructive step by others. From an orthodox perspective, learning degenerates if a report is required.

Fourth, one of the greatest challenges for a PBL facilitator is to intervene in the

group at just the right moment, not to disturb the group process: “The teacher was more passive and in the background (at least sometimes).” As I tried to facilitate sometimes up to six groups at the same time, this failed. “Getting guidance during the sessions was not easy since you had many groups at the same time.” Those sessions when I only had two, and in one case only one group, came out very successfully. Group size is also critical; six to eight students with a favor of eight is highly recommended to get fruitful group interaction. Facilitating base-groups is highly dependent on the engagement, both students and instructors: “I think you as a teacher were more engaged in these lectures than in the others, which contributed to the better.”

Fifth, location, that is the furnishing of the classroom. All the lectures were originally scheduled to rooms where all the furniture were fixed to the floor in face-forward and non-movable. This resulted in a very ‘non-creative’ setting. During these sessions, the base-groups had to form work-spaces where nobody were comfortable. Some groups that managed to find smaller class or group rooms with white board or equivalent did have a very fruitful group process. But this created logistical problems as I had to spend a lot of time finding the groups.

Finally, an holistic approach towards open learning, and preferably with problem based learning, is necessary to reach success. If only a few teachers during a program include open learning activities the students are likely to find them disturbing. “It is a problem that not more teachers use this approach.” But I am also convinced that a gradual approach to introduce open learning in existing institutions are more successful than attempts to convert a whole program without first gaining the necessary mind-set and experience with problem based learning.

Instead of Conclusion

The pilot project was a success though some mistakes where made. The previous section demonstrates some critical factors in approaching PBL as an alternative. In a teacher centered classroom, a strict hierarchy of expertise is maintained. When closed teaching is replaced in favor of open learning, more specifically PBL, students experience a new relationship to each other. No longer is discussion a matter of student responses to teacher questions. The students become a team that is characterized by cooperation rather than competition. With PBL, this team developed an healthy attitude to problems, knowledge and how to acquire this knowledge.

During the ten week course I found both frustration and an interest in different aspects of learning among the students. I also found a growing critique of today’s educational activities. Perhaps the most satisfying aspect of including PBL in the course was to see students transforming from rigid thinkers into more flexible thinkers who felt comfortable in less structured situations. Finally, I would like to conclude that practicing open learning and PBL, I will be comfortable in graduating professionals that will be shaping my future.

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