Provincial Designer Design: A Creative Mix of Hard Restrictions and Soft Visions

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Abstract. In assessing a Swedish undergraduate study program in information systems development the proposition is put forward that a process oriented curricula could be a promising alternative to mainstream content based ones. By further stressing a user perspective, creativity, and systemic thinking, conditions are created for putting technology to its best possible use in its service of human needs.

Keywords: Study Program, Informatics, Systems Design, Problem Focusing, Assessment.

1 Introduction

Due to a misplaced "X" in the governmental distribution matrix for higher education, a study program in Information Systems Development (ISD)[1] was started in Östersund, Sweden in 1977. Despite such an accidental start in a rural milieu far outside the epicenter of Nordic computing, a systems culture could be fostered and nearly one thousand students could successfully fulfill their ISD studies. The purpose of this paper is to highlight main opportunities, challenges, and pitfalls of such an unique opportunity.

2 The Context

The Östersund ISD study program was established and developed under very specific conditions. So, there was no history and no traditions in computing and computer related education at hand and neither the host university nor the local industry showed

1 "Systemvetenskapliga linjen" in Swedish

any deeper interest or engagement in the activity. Further, the resources were very limited and there was just a low research activity. While those factors at a first glance may seem having just negative impacts they actually turned out having a mostly positive influence.

Hence, the milieu become very agile and open to inputs from all over the world. Further, as there were few restrictions imposed from outside, the personnel working in the program had almost unlimited freedom for experimentation and creative design approaches. The absence of binding to expensive hardware also made it rather easy to follow the fast technical development within the IT sector. Due to the meager research opportunities, at last, the program itself turned out being the main research and development target [1].

3 The Inspiration

Even if the igniting spark came from Uppsala the design of the program in Östersund was from the start mainly inspired by the way studies were organized at the Royal Institute of Technology (KTH) during the sixties. The new Department for Information Processing (ADB) and professor B. Langefors [2] was part of that input but the main influence came from other KTH departments.

Over the years mainly professor Ivanov [3] in Umeå and professor Samuelson [4] in Stockholm had a distant but anyhow significant influence also on the activities in Östersund. Rather soon, however, Östersund became part of an international researcher network with St. Gallen [5], Fribourg [6], Washington [7], Hull [8], and San Fransisco[9, 10] among the main nodes. As those international contacts were highly stimulating it, however, partly shielded Östersund from deeper national contacts. Concerning technical aspects we found most inspiration by Sommerville [11] and Wirth [12] but also by professional organizations like IEEE/Computer [13] and ACM [14].

4 The Operation

The operation of the program can be characterized by both conservation and change. The vision to support Human Activity Systems [9] with the best information systems possible remained unchanged for the whole period. The ways and tools for reaching that goal, on the other hand, were under constant change. That change was driven by a Program Improvement System (IPS), which in fact was an expanded and completed course evaluation system. Nearly all stakeholders, i.e. lectures, students, external experts, and representatives from industry were engaged in IPS. In that respect we came close to Banathy's [17] vision of a third generation design method. Here all possible information was gathered during the year and used as input to annual design seminars. In those the program was designed with help of Ackoff's [16] Idealized Design.

This cycle of operation-design run very well for several years but was eventually overrun by changes in the host organization. Hence, the freedom and agility

successively disappeared and the responsibility was moved away from the lecturing personnel.

5 The Design

The Östersund program successively evolved over the years. Its idealized design [16] was finally grounded on the following cornerstones.

5.1 Program Focus

Contrary to [18] and many implementations of that curriculum the Östersund program had the problem domain as its main axis of attention (Fig. 1). In that respect the program followed the user orientation already advocated by Langefors [2]. That also made the program more process oriented and less content oriented compared to [18]. In that respect the program honored Popper's Searchlight Knowledge Paradigm [20].

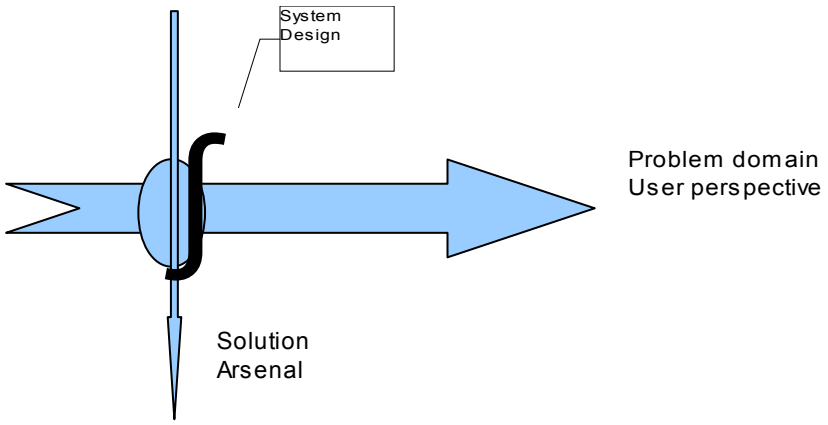

Fig. 1. The program space with a governing Problem domain axis and a serving Solution arsenal axis and with a Design focus.

Further, based on Beer's [19] statement that techniques and tools are no problem as long as you know what you will do, not much explicit time was assigned for the study of different techniques and tools along the Solution Arsenal, in fig. 1 represented by the thinner vertical axis. Far from all students agreed on that point but we still hold the assumption that a relevant amount of technical meta knowledge is the best approach for optimal application of a rapidly moving technology front.

The design focus in fig. 1 represents the core program goal of forming skills for solving human information and communication problems by applying best available techniques in an ingenious way. Very soon, however, we discovered that information systems design was just a special case of a more generic design science. Hence,

Simon [15], Warfield [7], Ackoff [16], and Banathy [17] became main inspirers for our design courses.

Thanks to Samuelson [4] the program from the beginning was embedded in a systemic framework. Hence, the term System Informatics (systeminformatik) was coined as a label. Ulrich [6] here helped us not overdoing the systems approach.

5.2 Expanding System Complexity

One core principles was to successively increase the complexity of studied systems [21] from deterministic and foreseeable ones to living [24] and complex ones. Hence, from a start in systems for personal study effectiveness the students studied computer- and program systems, information systems, and finally organizational systems. Thus, in later semesters very complex real world systems were studied and redesigned according to viable design principles [19].

5.3 Creativity and Problem Solving

Systems development and problem solving should be characterized by a high degree of creativity. On this point different creativity activities such as “six-thinking-hats” and “the devil’s advocate” were applied in order to minimize undesired thinking limitations [23]. Brainstorming, braindrawing and brainwriting were also used for supporting the students' lateral thinking and idea generation.

The studies were further characterized by a high degree of problem solving due to the assumption that students can solve any problem if they are given the chance [25]. Hence, the practical assignments were normally not "tested in advance" and the teaching team did not have any “right” solution.

5.4 Learning Approach

Learning by doing’ is a stimulating way of learning in line with Schön's [22] “*learning by experience and reflections*”. In the program assignments "close to reality” or assignments done together with different stakeholders, were appreciated by the students. The ability to communicate with “real” stakeholders, presenting different ideas as well as negotiating proposed solutions, were identified as an essential skill for information systems developers. Hence here the program was in conformity with Ackoff's [25] opinion that case studies and fictive descriptions never can work as well as authentic cases.

According to Warfield [7], the working environment is an important component in the design result. Hence, the program abandoned the computer lab concept and tried instead to create environments that as much as possible were like a normal working place. Hence, the students were free to, within limits, to equip and use their theme labs according to their own liking 7/24.

5.5 Theme Semesters and Course Teams

In order to avoid fractionating and in order to allow study of complex real world problems, courses of a certain length were found necessary. Hence, the idea of theme semesters were born. The program contained semesters for personal effectiveness in academic studies, computer systems, information systems, organizational systems, and knowledge creating systems.

Further, in order to cover all aspects of long and wide embracing courses and to give students best possible study conditions, the concept of Course Teams was born. The course team was together responsible for a theme semester and had to collaborate closely in order to fulfill their task. The team was composed as comprehensive as possible and with teachers on all academic levels. A model building on Warfield's [7] Sigma Five was developed as a guide for the teams.

5.6 Inter Course Interaction

"You always work for some client". Hence, in the program the different semesters had to interact with each other. This idea of using results from one course as input to another one were most distinct in three of our semesters - "Realization of Information systems", "Design of Information Systems", and "Strategy and Innovation" according to fig. 2. Hence, designs from semester five were handed over to semester three for realization. Vague management problems from semester six could be handed over to semester five for design of an appropriate information system. All this gave rise to valuable communication and negotiation experiences.

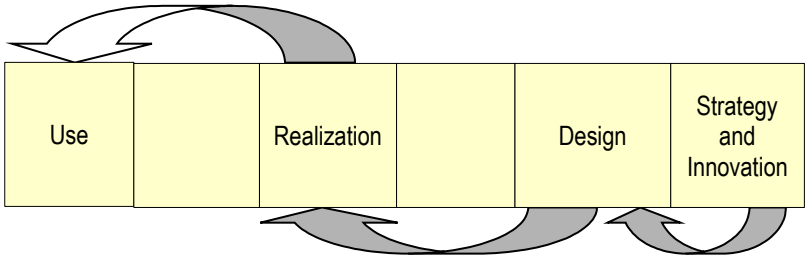

Fig. 2. Interaction between study semesters.

5.7 Meta Learning

Within a fast moving area like ICT the ability to learn during the whole professional period is judged more important than what you have learned during the undergraduate studies. Hence, in accordance with Popper [20] and in order to foster the desirable meta learning skill, the program was filled with the following meta learning moments:

- bachelor students had to make an independent compilation and assessment of current relevant research results,

- bachelor students had to make an independent implementation of a new research result in a concrete professional activity (bachelor thesis),
- master students had one semester where they had to completely plan and implement their own work. The only guideline they got was to develop a new idea or research result into a business they could live on,
- master students had to independently plan and realize a minor research project. The result had to be reported in the form of a scientific paper.

Besides that most students found those tasks extra challenging and stimulating the results often were surprisingly good. Hence, several students had their paper published in international scientific journals and others received best paper awards at international conferences.

6 The Outcome

Plans and design may be one thing. Results and outcomes often turn out being something quite different. Hence, in order to give an as balanced picture as possible, four former students will here give their personal account of what they judge being most significant in the Östersund program.

6.1 Professional Perspective

The Östersund study program aimed to prepare the future 'systems professionals' for a successful intervention of human, industrial and social affairs, by means of embedding ICT-artefacts into such contexts. Three key capabilities of this program's outcome will be discussed here. The first capability was the de-composition of the social and technological complexity providing skills to conceptualize any intervention-situation in terms of three layers of the intervened systems.

The first of these three layers is the *ICT-artefact layer*, with all its technical aspects, such as programming, configurations, testing, etc. This capability was provided the individuals by means of education and training centered on the construction of software and database systems, which enabled the professionals to understand the workings of this new technology.

The second layer was the *work-flow layer*, addressing the understanding of the work-processes, i.e. human activity systems, in and between organizations, that utilize ICT-artefacts. This conceptualization was provided to the future systems professional by means of education and training centered on the analysis and design of various work-flows and the identification of the requirements put on the ICT-artefacts. This capability enabled the professional to understand the logic of human activity systems, its challenges and also the potential value that modern ICT-systems may or may not contribute to the work-flows.

The third layer was the organizational *layer*, addressing a whole organization or a set of such, constituted by various interacting work-flows where the latter are executed by a configuration of ICT-artefacts and human actors.

This triplex, *artefact-workflow-organisation*, provided the professionals with 'intellectual spectacles' that enabled successful conceptualizations, interpretations, and designs, as well as the management of the various professional challenges at hand.

The second capability of the systems professional addressed the articulation and handling of the *gap between theoretical knowledge and professional practice*. All professions have their hidden professional knowledge that cannot be communicated via standard text books. Hence, by exposing the future systems professional for a well designed mix of theoretical bodies, e.g. software engineering theory, organizational behavior – and then a step-wise real-life application of these, followed by critical evaluation, the capability of linking the conceptual to the real was established, enabling future success!

The third capability addresses the distinction and opposition between *analysis and design*. The analysis, or the understanding of what exists by taking it apart (at least conceptually), is important and is well provided to most of us by our western cultural tradition.

However, even the best analysis capability cannot help us with the creation of a new reality. The latter requires the design capability, often allocated to "the strange artists"! By providing an exposition for the theoretical foundations – such as the Systems Sciences – and the practical and hands-on doings, of analysis and design, the capability to master these two mental and operational approaches, in a conscious and purposeful manner, was provided the future systems professional!

The three here detailed capabilities of the systems professional – the artefact-workflow-organisation hierarchy, the theory-practice abyss, and the analysis-design dialectics – are not enough for successful intervention of human, industrial and social by means of modern ICT-artefacts; they do however contribute significantly to a mastery of the real-life complexity in a manner that the systems professional would not like to be without!

6.2 Lecturing Perspective

Working together in course teams with academic teachers at different levels was a positive experience for all involved. The students became less dependent on one – or a few teacher(s) and it became easier to have access to a teacher for questions or discussion.

After some initial difficulties the teachers also found it more stimulating working in group than in isolation. The course team together with the students also became more like a normal working group and less like an artificial education set up. It was also found that the introduction of new employees was easier to carry through than before. Changing in manning was also experienced as easier though new engaged teachers and assistant teachers (students) was tutored of them who was leaving the course before they left. Teaching material such as assignments, laboratory lessons, instructions and different kind of practices, was also handed over by them who left the course team. No one "owned" his or hers teaching material – it was belonging to the team.

In summary, the most positive outcome from the team work was:

1. limiting of dependencies,
2. higher access for the students to responsible teachers,
3. increased democracy
4. guarantee for continuously improvements,
5. a well functioning tutor system – it was easier to come as a new employee.

6.3 Researcher Perspective

The Östersund program created the potential for an academic career and has been a good foundation for working as a researcher. The methodology focus in the program as well as the learning obtained and the development to an independent and creative person during the studies entailed a great potential to succeed as a researcher. There were also several opportunities to practice research already during the program, for example writing a thesis. The focus was on international conferences and journals and there were a lot of encouragements to get the article, written in the frame of the program, published. The students also got an understanding of the life as a researcher.

The Östersund program was further composed from a holistic view covering all the phases in the system development process. The successful mix of courses at different levels and with different directions made a holistic view of the program as well as the system development process.

In the program there was also space for enriching the studies with courses in other disciplines. As a student interested in research there were possibilities to chose courses in, for example, scientific methods, statistics, pedagogic, and psychology.

To sum up, the Östersund program created good potential and preparation for research work. In this life, the learning achieved, the holistic view and the skills obtained have been useful and made a good foundation. However, increased opportunities for participation in ongoing research projects during the studies had further improved the preparation for the role as a researcher.

6.4 PhD Student Perspective

To what degree did the program prepare for the exciting work as a PhD student? There is an old Swedish proverb saying practice gives skills. From that view the Östersund program prepared the students for an eventual academic career in the following ways.

Formulate relevant research questions and research problems are an important part of the Ph D process. In the pedagogical model of the Östersund program the students were made responsible for their own learning process. At the end of the program they also had to formulate questions for their bachelor and master thesis work. Those core elements of the program have given a good foundation to the ability to formulate questions and research problems.

Communicate with different stakeholders is another ability that is needed within the PhD studies. The program included several training opportunities in communication both with companies and the academic world. It was obligatory writing the master thesis in a research paper format, for example.

The Östersund program had a methodology focus which made the students prepared to solve problems in a methodically and reflective manner. This have been very helpful in the Ph D process partly because of the experience in using different types of methods but also by contributing with new insights based upon using different perspectives.

All those educational advantages shaped independent students. But there are of course also examples of things that could have been better. There were examples of some students that could work in ongoing research project during their studies but this should have been developed to a larger extent. Through seminars by the researchers about on-going papers and research projects the view of the academic career had become more interesting. This type of connections between research result and the education would have been valuable in all semesters.

7 The Ultimate Question

The program vision has been, "*Helping student master methods and techniques, which are not yet invented. In this way making them fit for handling future problems, which have not yet presented themselves"*. The ultimate question, hence, may be to what degree such a vision is too idealistic to fit into the modern factory metaphor that, at least according to many critics [3], prevails in our current universities?

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