The Influence of Feminist Theory on Informatics Course Design

Cecile K. M. Crutzen
Course Team Leader Informatics

Department of Technical Sciences, Open University of the Netherlands
P.O.Box 2960, 6401 DL Heerlen, The Netherlands
Fax +31 (45) 711486, Phone +31 (45) 762573, Internet "CCR@Ouh.nl"

paper no. 4/24

The Influence of Feminist Theory on Informatics Course Design

Cecile K. M. Crutzen

Department of Technical Sciences, Open University of the Netherlands
P.O.Box 2960, 6401 DL Heerlen, The Netherlands

Abstract
In this paper I will make explicit how my perceptions on:
- the relation between feminist theories on objectivity
  in the sciences and Informatics,
- the dynamic concept of emancipation in education,

have influenced the design of basic courses on Informatics and how these reflections have been guidelines for choosing the contents, the examples, the subjects and their sequence.

1. Introduction: the starting point

At the Dutch Open University (OU) seven different fields of study are offered to students by means of courses or packages of courses. One of these is Informatics, which falls under the faculty of Technical Sciences (TS). The educational concept of distance learning is achieved primarily through extensive use of printed self-study material. In addition to the printed material, computers are used for practical work, simulations and computer-assisted learning. Each course in the academic degree programme (5400 hours of study) consists of either 100 or 200 hours of study.

The course "Introduction to Informatics" (Mulder, 1987) is the current 200 hour basic course within the curriculum of Informatics. The faculty decided in 1991 to replace this course until 1994/1995 by three separate courses of 100 hours of study each. These courses are entitled: Orientation on Informatics (OI), Basics of Informatics (BI) and Contexts of Informatics (CI). The courses can be studied in the following packages: OI in combination with BI or OI in combination with CI. Each one of these combinations replaces the old course "Introduction to Informatics". For students who want to follow a full academic programme in Informatics, the package of the three courses is compulsory.

The potential target group of students globally can be described in two groups. One group includes those who only require a basic knowledge about a broad spectrum of Informatics and a specific knowledge of the relation between Informatics and their own field of study or profession. These students do not intend to study a full programme on Informatics. The other group is made up of those students wishing to make a thorough study of Informatics.

The main reasons for the faculty (TS) to replace the old course were: the 200 hour course was not up-to-date anymore. Furthermore the new courses should accommodate the wishes of different student target groups better. The new courses should fulfil a broad spectrum of needs for knowledge on Informatics.

The ratio of male and female students on the old course "Introduction to Informatics"

can be interpreted as showing an under-representation of female students. In the year 1992 only about 18% of the students on that course were female. Comparing male and female students of the faculty (TS) it can be seen that the age structure of the male and female students is very similar (55% of the students are aged between 26 and 35). There is a difference, however, in the education level and the professional distribution between the sexes. Women who are studying a course within the faculty have a higher education level. 81% of the men and 62% of the women have a job for more than 25 hours per week (OU, 1993c).

The emancipation of the institution (OU) and the faculty (TS) was motivated by the wish to encourage the participation of women in Informatics. They wanted to increase the number of female students in both an absolute and a relative way. The increase should not only occur in relation to the number of female students starting with a basic course on Informatics, but also in relation to the number deciding to go on with a degree in Informatics.

In the year 1989/1990 the faculty executed a project on "Woman and Informatics". In this project it was impossible to change the content of the course because the written material already existed. In that project new measures were only taken in the field of recruitment and tutoring. Some of the measures taken in that project which were appreciated by the students are to be adopted in the tutorial scheme and in the recruitment of female students for the new basic courses. The women who participated in the project were, in comparison with some control groups, relatively successful in completing the course. However most of the participating women did not decide to start a follow-up course in Informatics.

The main reason was that most of the female students in the project followed this course to have some basic knowledge on Informatics. On the other hand, it may be justifiable to say that the content of the course was not encouraging enough for them to reconsider this initial intention (Crutzen, 1991; Crutzen, 1992; Vlas, 1992; OU, 1993d).

2. Dynamics of woman's emancipation in education

In developing course-material, one has to consider, how emancipation can influence the design of a course (or a curriculum). In designing a course one needs to include the answers to the following questions:

- What are the subjects and what is the content of the course?
- For whom is the course developed (what is the target group)?
- How will the content of the course be taught?

2.1. The interaction of emancipation processes with the process of curriculum transformation

The influence of emancipation is visible in the way these above-mentioned questions are addressed in the design. The particular view of the course designers in relation to emancipation and the relationship between emancipation and education will be visible. The perception of the concept "emancipation" is not identical for every institution, faculty or course-designer. It depends on their aims and targets.

Emancipation itself is not static but dynamic. Emancipation is a process; a process of transformation of a particular view on emancipation. The transformation of a curriculum and the design of a course are also a process. All these processes could interact. The emancipation process could cause changes in thinking and transformation in the process of course design and vice versa.

The way in which the relation between emancipation and education will be realised in a course-design depends on the actual view that the institution, the faculty and the course-designers have on emancipation. The realisation will become problematic if the views of these groups are different. Different views may cause conflicts in the production and the exploration phases of a course. Analysing the kind of views, which exist, is essential for the implementation of a course or a curriculum. In general the characterisation by Christina

von Prümmer of the German OU, also fits to the Dutch OU, especially the invisibility of women on the teaching staff and the invisibility of female views (Prümmer, 1993).

2.2. The deficit view

Within the Dutch OU and the faculty (TS) it is still a very widely held view, that emancipation means making up deficits (of women); deficits in terms of women to the subject matter, deficits of women in terms of desired skills, deficits in the participation of women in OU courses and their participation in the faculty. "From the start of the Dutch OU we are legally liable to pay attention to groups which have deficits, such as women, ... has been our aspiration to equalise the amount of female and male students". The policy will be "to remove barriers and to make products which will also be attractive to women." (OU, 1993a). The "deficit"-view often leads to strategies such as "catch-up" education, compensation education, women-only education. This strategy is static because the standard (of content and didactics) will not change and will remain mainly suited to an ideal typical male student (Prümmer, 1993). This kind of education only demands extra energy on the part of the deviant group (mostly women). The "deficit"-strategy can only become dynamic if experiences with this kind of women-only education lead to new definitions of content and didactics and a transformation of the view on emancipation. This process may result in the reconsideration of the established standards, a change of the standards so that the deficit and the advantage of every target group of students balance each other out. Energy for catching up on deficits will be generated by spare energy out of the advantages. The strategy of changing content and didactics, will place the course into the centre of the total student population and is dynamic in itself. Deficits and advantages are relative and not absolute; it depends on the choice of the standards.

Within the faculty, the experiences and the results of the "Women in Informatics" project have had an influence on changing the content and the didactics of the new basic courses. In (Mulder, 1992) a plea was made for a "plural curriculum in Informatics" with the possible outcome of diminishing "the sex differences on education of Informatics."

2.3. The women-friendly view

Another common view of emancipation is the idea of being "women-friendly"; of making women-friendly course-material, making the organisation and the structure more women-friendly, etc. However replacing the word emancipation by the word women-friendly is just a reallocation of the problem. What makes course material women-friendly? What are women-friendly examples, contexts and metaphors?

In the past women-friendly examples were often understood as women-only examples, in which women appear and in which women are visible (and men invisible), in which women were the better people or in a better position in comparison to men. Are contexts such as kitchen, household, motherhood, etc, which are supposed to bear more relation to women than men more women-friendly? The current view of women-friendliness is a trap. It will stabilise the dichotomy of male and female. This concept may lead to men-unfriendly material and will destroy the communication bridge. Above all this term suggests a very paternalistic view of protection of women, which puts women in a very isolated position. This type of women-friendly material, for the most part, lacks challenge or provocation. It has no dynamics in itself and offers no "edges" of change for women.

Transforming the view of women-friendly into gender-neutral is not preferable. "The content of educational curricula cannot be gender-neutral since in any learning process connections have to be established to the experiences and emotions of the learners and these experiences seem to be gender specific." (K. Reisby, quoted in Brock-Utne, 1993). Gender-neutrality could give a very unrealistic view on the world as it is. Students cannot relate the subject matter to their own daily practice. The real world is not gender-neutral.

Therefore changing the view of women-friendly into people-friendly or people-plural is a preferable option. It could mean, for example, placing people in the centre of the course and making the variety in the relations between people to the subject matter more

visible. This means also showing that these relations are not always gender-neutral.

2.4. The integration versus the separation view

Another strategy to change the content of Informatics courses is to produce a course where women will be taken up as a special case and where "women's issues" will be examined and placed into a feminist conceptual framework (Rothschild, 1988). This type of separate course has the potential to be of great value in enlarging the feminist awareness of the faculty (TS), but would at this moment in time have the effect of isolation and could inadvertently mean that as a consequence no further efforts are made to integrate feminist thinking into the basic courses of the curriculum. Until now the Dutch OU has little experience of developing Women Studies' courses. The faculty (TS) has no experience at all of this.

At the start of the Dutch OU integration was an explicitly chosen strategy. "...It was easy to argue for the inclusion of Women's Studies in the curriculum, and all the requisite conditions seem present for integrating Women's Studies in the curriculum" (Oudshoorn, 1988; OU, 1993b). Recently the OU deviated slightly from the absolute integration strategy. It was decided to develop a design for a Women's Studies curriculum with "Women and Technology" to be one of the topics within that curriculum. Whether or not the OU will produce that curriculum will depend on financial resources (OU, 1993b).

Furthermore it is very doubtful if a very isolated production of a "Women and Technology" course could at this moment have the effect of changing the content of the basic courses on Informatics. On the other hand one of the outcomes of the "Women in Informatics" project was that some faculty members by undertaking this experience made a start in thinking about emancipation and how emancipation could lead to a transformation of the content and the didactics. This was especially the case in the area of tutoring. By not "ghettorizing" this experiment as a women-only course, it has become a part of the integrating process (Rothschild, 1988). In terms of the future it would still be very useful to produce a "Women and Technology" course. It would have been better for the faculty if the production processes of the new basic courses and a Women's Studies course were parallel and therefore interfered with each other.

2.5. The chosen view

The concept of emancipation chosen in the design of the new basic courses in Informatics was not of separation but of integration of female views in the course. The first course (OI) does not include a separate chapter about the position of women in this particular field of study and profession in Informatics. Separation means that women would be considered as "different", different to the male standard. Integration of female views in the standards makes the individual or (group-) deviations of man and women natural.

Changing the standards by the integration of female views in Informatics courses is only possible by listening to the various "voices" of female theories, female computer scientists and female course designers (Crutzen, 1992). It will be explained in the following paragraphs, how this process of listening is made visible in the course design.

3. The process of designing a course

In being responsible for the designing of a course on Informatics you can ask yourself the same questions as Susan Leigh Star: Will I support Informatics as it is? Do I want more women in computing? Do I have the expectation that computer science will change if more women are insiders? Do I want inclusion, revolution or a new global order? (Leigh Star, 1991). I can formulate my answer to the above dilemmas in a general way.

It is my intention to involve more women in Informatics and to provide them with both tools and methods. I want to enable them to communicate and to think on the subject matter. Information technology will invariably influence their lives. They need to have knowledge on the subject, before they can decide to get involved. I do not want, however, to give the responsibility for bringing about a change in Informatics to women

only.

As a female scientist I want to make myself responsible for changes by "Making my view visible for myself". In developing course material "I could think about directions in which computer science could or should change. Perhaps then it may be possible for the content of an information system (IS)" (and Informatics as a whole) to become "a representation of a real world where hand, brain and heart are united. As female computer scientists we are obliged to do so" (Crutzen, 1993), because "The feminist theory of knowledge differs from the perspective of man's distinctive activity and experience... Its distinctiveness is to be found in the way its concepts of the knower, the world to be known and processes of coming to know reflect the unification of manual, mental and emotional activity characteristic of women's work more generally." (Harding, 1986).

I agree with Birgit Brock-Utne when she says "I see a great need for curriculum workers to voice their values place and their solidarities ... For a radical feminist educator it will be of more importance to analyse the values taught through science education and work for a change in the curriculum of science than just getting more girls in the field" (Brock-Utne, 1993). My solidarity is with women whose experiences are made invisible in course material.

Looking at the background of future students, these basic courses could build a communication bridge between groups of people which are at this moment often isolated and placed opposite to each other e.g. users versus designers, software engineers versus domain experts, men versus women, human scientists versus exact scientists.

4. Views on Informatics and science

As a designer of a course on Informatics you have to be aware of the following facts in science and especially Informatics and you have to analyse what the options are for changing such facts:

4.1. The relation between objectivity and masculinity (Oudshoorn, 1988)
"Representation of the world, like the world itself, is the work of men; they describe it from their own point of view, which they confuse with the absolute truth." (quoted from Simone de Beauvoir, 1970, quoted in Fox-Keller, 1985).
On the other hand, I agree with Haraway that it is not preferable being trapped by two poles of a tempting dichotomy on the question of objectivity (Haraway, 1991). That would destroy the people-plural view.

The course material will not include "parables about objectivity and scientific methods". By getting students involved and taking part in the process of making knowledge, they will become aware of the fact that knowledge is "situated" (Haraway, 1991). In Informatics one of the main activities is making models of the real world. Students should be aware of the fact that modelling is not an objective activity. Modelling could mean making the visible invisible but also mean making the invisible visible. What is visible in a model involves a "situated choice". Even an abstract description of an IS itself in a syntactically correct way always suggests that the IS itself is objective and that all ISs have the same absolute structure.

ISs influence the real world and contain models of parts of reality. Therefore ISs should be transparent and flexible in the way that they are structured and constructed (Crutzen, 1993).

Following these reflections it was decided that the development of the concept of the "IS" itself, its components and environment is one of the basic (and starting) learning activities of the students in the first course OI. The process of developing, especially the design process of several specific ISs, will be one of the main subjects of the three courses. Students should be aware that modelling is a working process. "Work is the link between the visible and the invisible. Visibles are not automatically organized in pregiven abstractions. Someone does the ordering, someone living in a visible world." (Leigh Star, 1991). Work will transform a static view of objectivity, which students may

get only by presenting the products and not the process of modelling, into a dynamic view of objectivity as intended by Fox-Keller. Dynamic objectivity is "the pursuit of a maximally authentic, and hence maximally reliable, understanding of the world around oneself. Such a pursuit is dynamic to the extent that it actively draws on the commonality between mind and nature as a resource for understanding. Dynamic objectivity aims at a form of knowledge that grants to the world around us its independent integrity but does so in a way that remains cognizant of, indeed relies on, our connectivity with that world." (Fox-Keller, 1985).

4.2. The focus of scientific thinking on mastery and control
(Oudshoorn, 1988)
"The subsequent history of science provides abundant evidence that the values articulated by early modern scientist were in fact effective in promoting those kinds of knowledge that would lead to mastery, control and domination of nature." (Fox-Keller, 1985).

In the courses the point of view will be taken, that ISs do not have a function of control but of support towards their environments. An IS communicates with its environment and is not isolated. An IS has methods to receive information, to process information and to send information. For the environment of an IS only the function of support and not the internal way of processing is important. It is essential what kind of information can be communicated to the system, what questions may be asked and what the possible system responses to the environment are. In these courses, the environment itself is considered as an IS which has an interactive communication relation with the supporting IS.

By doing modelling by themselves students will become aware that every IS is a model and contains a model of its environment and of a domain. The structures and the organisation of the "world-as-it-is" are physically and conceptually implemented in an IS and are visible in the way how ISs communicate with their environments.

It is therefore very important for the students to realise that there are value judgements in the analysis and acquisition of knowledge (Metselaar, 1991). For that reason not only the techniques of modelling and knowledge acquisition should be learned by students. Students should be aware of the social and political issues of modelling processes too. In the course material the examples of modelling are placed in contexts of participatory processing of the several actors in a design process (Greenbaum, 1991). The students themselves will be involved by asking them frequently about their opinions. The modelling methods used throughout the courses are not described as the "best" methods but as examples of methods which are embedded in a general concept of communication. Which methods are considered of value will depend on the situation and the resources for implementation. Students will be acquainted with the fact that a combination of methods gives more views and more variety in the views of the part of world which is to be modelled.

4.3. The impact of female experiences on scientific thinking
(Oudshoorn, 1988)
Marilyn French claimed that personal questions are manifestations of a political power structure in the society (French 1986, quoted in Brock-Utne, 1993). "The personal" could be a starting point for collecting the strength to dissolve the isolation. By making my view visible for myself, I could then think about directions in which Informatics could and should change. By making experiments such as the "Women in Informatics" project (Crutzen, 1991), I can explicate to our faculty the experiences of women, studying at the OU and especially at the faculty (TS).

Female experiences have lead to the revaluation of differences in comparison with similarities (Suchman, 1991). "The representation of phenomena in the IS should not only be based on the decision to put some phenomena into one class because of similarity but also on the decision to put some phenomena in different classes in spite of similarity. The methods of abstraction and especially classification should maximise reciprocity and

appreciate difference. Not only the analysis methods should have these characteristics. But the persons involved in the modelling process must have "the other incorporated into the self rather than dominated and/or repressed."" (Crutzen, 1993; Harding, 1986).

These considerations have lead to a specific analysis method in the courses where classification is placed to the end of the analysis process. Classification is only preferable when there are enough similarities if it does not result in ignoring differences and if could lead to more clarity in the model and in the implementation of the model.

4.4. The existing dichotomies

In western educational culture many dichotomies exist, such as those between human-sciences and technical sciences/mathematics and between emotion and intellect. This results in the isolation of techniques and methods in technical sciences from the persons who use and develop them. In education these dichotomies are visible e.g. abstraction often means to disconnect the subject matter from reality.

"Technologies result from a series of specific decisions made by a particular group of people in particular places at particular times for their own purposes." (Wajcman, 1991). Technology is developed by people and is used by people. Technology is not an independent artifact with an autonomous evolution. This view is made visible in the courses. Contexts and examples are the medium for relating people to the subject matter. They will be taken out of the experiences of women and men at the present time and in this country. The view, the role and the position of the different people in the context situation will be made visible. The relationship between the problems of people and the specific solving strategy they choose will be explicated.

The basic description of ISs is not a technical description of the hardware and software components of such systems. The basic description is based on the definition that an IS is a system of people who communicate with support of technical tools. ISs are built by people and made to support people.

The description of an IS is fundamental because every OU course, especially a basic course in Informatics is, as such an IS for students to enlarge their knowledge. In the future the basic Informatics courses could be the IS that will support the communication between several groups. One of the challenging targets of these basic courses was the desire to create an information bridge for several interest groups such as designers and users of systems.

The language used in the course material itself is one way to check whether the relating of the subject matter to reality is realised. One of the instructions to the authors was to avoid phrases such as "data is sent" and "models are made". The persons (or machines) who do the activity become invisible in these types of sentences (Crutzen, 1992).

5. The choice and the sequence of the subject matter for tuition

5.1. Prior knowledge and skills

In choosing the subjects for the orientation course (OI) it was important that no specific acquaintance of the students with the subject matter would be expected. There will be anticipated on the daily-life knowledge of the students. Everybody has some intuitive unreflected experiences related to ISs and their functions. By using examples and contexts from daily life, students should become aware of their implicit knowledge. In this way this knowledge is made explicit. This will be for them the trigger to ask questions such as "How does it work?" and "How can it be made and developed?" This didactic concept can work for the whole group of students if the choice of examples and contexts in the course is differentiated and not neutral. The appearance of women and men in the course material should be in balance in terms of quality and quantity. Particularly women should appear in active roles.

The course OI starts with an overview of the subject matter by discussing and providing practical experiences with ISs and the application of ISs within organisations. Applications are such as that providing health care, especially in hospitals, such as the

Dutch railway organisation and the application of an IS to control the movements of a robot.

Through the practical work students become familiar with using a computer system. They gain basic skills in working with a spreadsheet application, a word-processing application and a database application. It gives students, who have not worked with computers before, a feeling of confidence. The aim in starting with practical work is to give students the feeling that working with a computer is just a matter of doing. The decision made to start with learning instrumental and operational skills, is to ensure that students who do not have practical computer skills know exactly what kind of skills the have to know to be successful in this course on Informatics. They can also overview the influence of computer systems on a total IS. D.C. Martin and D.R. Bernstein suggest that this "application approach" for the introduction of the fundamental concepts of computer science is needed to increase confidence and the sense of being in control. "Such a course would tend to be an equalizer, empowering those who had not had high school programming as well as those who had. Women would see the usefulness of computers..." (Bernstein, 1992; Martin, 1992).

5.2. Cyclical construction of the course

Through the medium of examples and contexts from daily practice, it is possible to introduce new concepts on the basis of a common understanding of that concept. At the introductory stage of the course the concept will not be gone into in depth. Concepts will appear and be developed in a cyclical way and will not be developed in a top-down or a bottom-up way but from the centre outwards. Concepts will reappear frequently at different points in the courses. Concepts will be expanded and will be related to other concepts.

5.3. The basic frames of the course

Each subject will be placed in a frame before zooming in on the subject and treating it in detail. The frames are developed from examples already introduced. A frame is a kind of abstraction but, by linking these abstractions with examples, students get the feeling that they are doing the "ordering". In the opinion of Susan Leigh Star it is not always necessary for students to "restore the visible" at every passage in the course (Leigh Star, 1991). They can always remember the work through the examples. By not forgetting the work you can always make "the invisibles" visible again. Developing frames is a working process. The basic frames in the course are:
- Information systems and their environment.
- Communication between information systems with the four elements:
  The semantic, pragmatic, syntactical and physical aspects of communication.
- The process of developing an information system.

The old course "Introduction to Informatics" (Mulder, 1987) was divided into five independent topics:
- Information systems and the impact of information technology
  on society, organisations and people,
- Problem solving and the design of algorithms,
- Programming algorithms in Pascal,
- Data modelling, data structure diagrams, data bases and query languages,
- Computer architecture, operating systems, data communication
  and computer networks.

In that course these topics were treated relatively as independent to each other. These topics are still of importance in the new basic courses but they will be treated in terms of their relationship to each other and will be placed in the basic frames.

5.4. An example of a basic frame: communication

A typical route taken in the new courses is that of the basic frame "communication". The frame "communication" is introduced in the beginning of the OI after setting the basic frame "Information System".

Communication between people, within and between ISs and between people and ISs, is only effective if the communication partners have some sense of community in the way they see the world and if they have a common language.

Communication is the basic frame for the more technical and physical aspects of ISs such as the physical representation and transportation of information and the relationship between the hardware and software components of a computer system.

In part 4 of the OI course and in the BI course the products from several phases of the development process will be represented as a message being sent from the "sender phase" to the next phase i.e. the "receiver phase". Each phase in the development process has its own semantics and pragmatics. The language (or methods) used to represent several products in the development could be different but this is not always necessary. The choice of language depends on what will be represented and what the pragmatics are of these products.

Communication on the domain by the participants in the process-modelling and data-modelling part of the development process is the main source for the production of a model of the domain. The domain itself will be represented as a system of separate communicating objects.

In the last part of the OI course and in the CI course communication between people and ISs (human computer interaction) will be deepened.

The principle of setting a frame before zooming in on details is one of the main principles in the courses. The frames will be filled in and enlarged in a cyclical way as the above example (that of "communication") has shown. In the courses frames are the tools for relating new knowledge to old knowledge, one of the most mentioned recommendations in several publications on female ways of learning in computer science (Brecher, 1989; Casimir, 1988; Rikhof, 1992).

The choice for communication (and several types of languages) as one of the basic frames was done for several reasons:

• To avoid the students assuming that the world models they produce are "shaped not by languages but only by the demands of logic and experiment" (Fox-Keller, 1985). Languages are not transparent and the language used in Informatics is not "absolute". In the course attention will be paid to several formal and informal languages and other representation methods showing students the advantages and disadvantages of each especially of formal languages and their relationship to logic.

• To avoid the isolation of Informatics. Language may not be used as a "border" to Informatics (Fox-Keller, 1985). Language has to be the medium for communication in the working place of all students independent of the roles they will play f.e. the roles of user, analyser, designer, technician, domain expert, etc.

• To make it possible to model the communication about the world and represent interactions and relations within the real world in the model by non-hierarchical communication networks.

I hope, that with my assumption to make communication to a central issue in the course, I can contribute to making one of the first step to find the directions in which changes need to be made in Informatics and the teaching of Informatics. We have to learn to "see" and to "represent" the various non-hierarchical structures. Informatics as it is practised at the moment is strongly hierarchical, hierarchical in terms of the position of the analyst towards the world of observation, hierarchical in terms of the steps in the design process (classification, followed by instantiation), and hierarchical in terms of the product (the appreciation of inheritance) (Crutzen, 1993). "... indeed it is likely that we can understand only those systems that have a hierarchic structure." (Booch, 1991).

On the other hand teaching students the different aspects of communication, does not necessarily develop in them the right attitude in order "to listen, to anticipate and to speak" in their (future) working environment. Developing these skills in the students is very difficult in distance learning and is a problem which remains largely unsolved in any distance learning education environment.

5.5. An example of content: process of development

Another basic frame in these courses is the development process of an (information) system. In the fourth part of the OI course an overview of that process will be given. A development process is introduced as a cyclical process with the following phases: analysis, design of solution, implementation and evaluation.

In the OI course the focus is on the process of analysing and designing a solution, and on the relation between the evaluation of an IS and the models produced in the analysis and the design phase. For this reason several examples will be analysed by the students. Implementations of these example models will be offered to students. By evaluating the function of those implementations, students get opportunities to make proposals for changing the models or changing the organisation of the domain and the environment of the implemented IS

In the BI course the main subject is the development process of an IS. Students can acquire skills for executing the whole internal process of development (object and communication modelling, design of solutions, implementation by programming, database systems or spreadsheets, evaluation of the implementation).

In the CI course the topic is the relationship between the basic frames and the environment; for instance, how the environment of an IS is reflected in the system itself and its design and how the relationship between users and the design process can be realised.

The analysis process is described as the modelling of information on the domain and also as modelling of the mutually beneficial communication requirements of the environment and of the IS. The domain model and the communication requirements are represented by a subset of natural language.

The domain model is a model of dynamic non-hierarchical interaction between the objects of the domain. The projections in the IS of the objects are information-objects. The interaction of these objects will be modelled as dynamic non-hierarchical communication between information-objects. The definition of an information-object is based on general agreement on the basic "information system" frame and the basic "communication" frame. The choice of the different objects is represented as a subjective choice. It is a choice that depends on the information requirements, on the type of solution, on the kind of implementation, and on the views of the design participants. Object typing will be permitted after a survey of differences and similarities has been conducted. In the analysis phase it is not very important to recognise inheritance relations between objects. Any object can be described in terms of its qualities and behaviour. Any object is, in principal, autonomous.

The total process of analysing is described as a cyclical process of subjective choices with the following main actions being as follows

1. Choosing the objects.
2. Representing information on the objects, including the description of a global life cycle in terms of significant states of the object.
3. Representing the interaction of the objects.
4. Translating the interaction into communication; describing the semantics and the pragmatics of each message.
5. Specifying the "behaviours" of the information-objects (as responses to received messages).
6. Documenting and representing the interactions between the domain objects as a "non-hierarchical causal communication network of information-objects"; completing the information-object descriptions.

In these courses, we do not want to give rules for the choice of "good" objects or "good" object-classes as many authors do in the literature provided, e.g. (Booch, 1991). The choice of objects and the classification of the information-objects is subjective and is influenced by the experiences of the analyser and of the domain experts, the

implementation tools and the prospective users of the IS. We want to avoid a situation where "the concept of classes has the same effect as the concept of laws" (Crutzen, 1993) of which Fox-Keller noted that "such laws imply an a priori hierarchy between structuring principle and structured matter that suggests a striking resemblance to laws of authoritarian states." (Fox-Keller, 1985). The class structure and a pregiven algorithmic method for classification will suppress "listening to the material itself" (Crutzen, 1993; Fox-Keller, 1985).

Therefore in the course material not only the products of the analysis process will be represented. Of greater importance is the process of modelling itself and the choices you may have. A development process is not a deterministic procedure which can be extensively automated as some literature on Informatics suggests.

Modelling the world in this way is no guarantee for a "gender-free" description of the world. The content of a specific model can be very hostile against woman. For example in (Jacobson, 1992) a context is chosen for explaining the representation of the real behaviour of persons by means of methods of information-objects and by explaining how different methods will result in different classifications of an example of the object class "Person". Jacobson divided the object class "Person" into two sub-classes "Male" and "Female" because they have a different dance behaviour. He explained his view on the world by saying "We also see how we have defined the operation to dance. It differs only slightly, in this example, between the two sexes. Both men and women move their bodies but in slightly different ways. Moreover, women will only dance if they have a friend to dance with".

Modelling with objects in the way it is explained in my courses is intended to be very transparent for users. Users and analysers will be enabled to discuss all items in the process of analysing and in the process of evaluation. Modelling methods of this kind enable users to propose model changes. This is feasible because a change in the model now can be reduced to a change of an information-object.

The focus on the relationship between the analysis model and the implementation evaluation was an explicit choice for the OI course because this course will have the most varied student population. A good understanding of this relationship will contribute to attitudes of participatory design in the students in their future places of work.

6. Conclusion

Making an ideal design in a feminist way means making compromises and finding obstacles during the process of production and implementation of such a course. For instance:
- there is no literature providing prototypes of methods and examples,
- new courses should not be revolutionary but evolutionary in relation to already existing specialist follow-up courses,
- the use of well-known metaphors often implies a traditional assignment of roles.

The main problem is that as a course designer you have your own private process of analysing and designing the course. This process is invisible to authors who will write the material and to faculty members. Making this process visible to authors and faculty members is a necessary condition for success and it is even of greater importance that their creativity and energy is focused on this deviant approach of Informatics. As a course team leader you have to connect their aims (whatever they are) to your aims (of emancipation). For the authors and me this was not an easy process because you have to walk on a path full of potholes. As a course designer it is your task to pave the way with "stepping stones". I owe many thanks to Drs E. Brok and Dr. H.-W. Hein who have carried a lot of stones for me.

References

Bernstein, D., R. (1992). A New Introduction to Computer Science. In: In Search of Gender Free Paradigms for Computer Science Education. Martin, D. C., Murchie-Beyma, E. (eds.). Intern. Society for Technology in Education, Oregon.

Booch, G. (1991). Object Oriented Design with Applications. Redwood City, California: The Benjamin/Cummings Pub. Comp.

Brecher, D. (1989). Gender and Learning, Do women learn differently? In: Haar Digital, symposiumverslag, Oricom Amsterdam.

Brock-Utne, B. (1993). Feminist Didaktik - the why, what and how to teach women. In: "Feminist Pedagogy and Women-Friendly perspectives in Distance Education", International WIN Working Conf., Umea, Sweden, June 1993, The Women's Studies Center of Umea, report No.4,1993, ISSN 1101-847x .

Casimir, G., Spetter, J. (1988). Goed geïnformeerd (Vrouwen oriënteren zich op informatica). Stichting Burgerschapskunde, Leiden.

Crutzen, C.K.M., Vlas, W.D.J., Joosten, G.J.M. (1991). Women in Informatics at the OU of the Netherlands. In: IFIP TC9/WG 9.1 Conf. on Women, Work and Computerization (Helsinki). Elsevier Sc. Publ., Amsterdam.

Crutzen, C.K.M. (1992). Aspects of emancipation for the production and exploration of an introductionary course in Informatics. Internal Note of the faculty TS, Heerlen, November 1992.

Crutzen, C.K.M. (1993). A female view on the design of Information Systems. In: Contr. GASAT 7th Int. Conf., The University of Waterloo (Ontario), Canada.

Fox-Keller, E. (1985). Reflections on gender and science. Yale University, Vail-Ballou, Binghamton (NY).

Leigh Star, S. (1991). Invisible Work and Silenced Dialogues in Knowledge Representation. In: IFIP TC9/WG 9.1 Conf. on Women, Work and Computerization (Helsinki). Elsevier Sc. Publ., Amsterdam.

Greenbaum, J. (1991). Toward Participatory Design: The Head and the Heart Revisited. In: IFIP TC9/WG 9.1 Conf. on Women, Work and Computerization (Helsinki). Elsevier Sc. Publ., Amsterdam.

Harding, S. G. (1986). The science question in feminism. Cornell U. Press, Ithaca.

Haraway, D. J. (1991). Simians, Cyborgs, and Women. Free As. Books, London.

Jacobson, I. (1992). Object-Oriented Software Engineering. Addison Wesley, Reading (MA).

Martin, D. C. (1992). Report on the workshop: In search of Gender Free Paradigms for Computer Science Education. In: In Search of Gender Free Paradigms for Computer Science Education. Martin, D. C., Murchie-Beyma, E. (Eds.). Intern. Society for Technology in Education, Oregon.

Mulder, F., et. al. (1987). Introductiecursus informatica. Dutch OU, Heerlen.

Mulder, F. (1992). Identiteit van Informatica-onderwijs. Dutch OU, Heerlen.

Metselaar, C. (1991). Gender Issues in the Design of Knowledge Based Systems. In: IFIP TC9/WG 9.1 Conf. on Women, Work and Computerization (Helsinki). Elsevier Sc. Publ., Amsterdam.

OU (1993a). Zien is kopen, weten is meten. Internal report OU U93/19.662, Heerlen.

OU (1993b). Rapport van de programmeringscommissie Vrouwenstudies. Internal report OU, Heerlen.

OU (1993c). Studentenstatistiek-rapport. Internal report OU 16-VII 1992, Heerlen.

OU (1993d). Het Project Vrouwen en Informatica aan de OU. Crutzen, C.K.M, Joosten, G., Vlas, H. (eds.), Internal reports OU, U93/22534,22535, Heerlen.

Oudshoorn, N. (1988). Towards a More Women-Centred Approach for Distance Education Curriculum (The Netherlands). In: Toward New Horizons for Women in Distance Education. Faith, K. (Ed.), Routledge , London.

Prümmer, C. von (1993). Women-friendly Perspectives in Distance Education. In: "Feminist Pedagogy and Women-Friendly perspectives in Distance Education", International WIN Working Conf., Umea, Sweden, The Women's Studies Center of Umea, report No.4,1993, ISSN 1101-847x .

Rikhof-van Eijck, M. (1992). Verschillen in leerstijlen tussen mannen en vrouwen. In: Congresbundel NIOC '90, Kluwer Bedrijfswetenschappen, Deventer.

Rothschild, J. (1988). Teaching Technology from a feminist perspective. Pergamon Press, New York.

Suchman, L. (1991). Closing Remarks on the 4th Conf. on Women, Work and Computerization: Identities and Differences. In: IFIP TC9/WG 9.1 Conf. on Women, Work and Computerization (Helsinki). Elsevier Sc. Publ., Amsterdam.

Vlas, W.D.J., Crutzen C.K.M. Joosten, G.J.M. (1992). Emancipatorische onderwijsmaatregelen binnen de Introductiecursus informatica. In: Congresbundel NIOC '90, Kluwer Bedrijfswetenschappen, Deventer.

Wajcman, J. (1991). Feminism confronts technology. Polity Press, Cambridge (UK).