e-Learning, Gender Sensitive

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Abstract

With the introduction of new media in education the possibilities for using technological means in didactics, organization of learning and content presentation have extended. But the appropriation of these devices and possibilities, like all artefacts, also is a cultural means and it makes culture. Thereby also symbolic connection between gender and technology come into play. In fact sometimes effects on inclusion versus exclusion of groups of people, as women have been observed. On the other hand it can be expected that with growing intensity and broader use of the technical means these barriers are sinking. This for two reasons: Once the rising diversity of user groups requires possibilities for adapting technological means and media didactics to their wishes. On the other hand also more diversified groups of users become more familiar with the technical means thereby mediated education.

The text deals with changes mediated education has to take in order to include diverse groups, respecting especially gender and other cultural, ethnical and age diversities. The effects of e-learning on these groups have been analyzed in several investigations, many of them also showing gender and other differences in one or the other category. Concerning gender and all other diversities, in this text the intentions are deconstructive, that is we do not presuppose biologically essential gender (or other) differences in competences, attitudes, motivations etc., but only socially constructed ones. This brings about difficulties: The analysis of gender and other differences can easily turn into self referential results and facilitate essentialist beliefs. This paradoxical situation has to be handled and we will present possibilities for it. To this aid we present empirical results, which are refined with respect to gender together with other items, such that gender differences can be deconstructed by dissolving them into other differentiated categories.

Key words

gender studies in computing, co-construction of gender and technology, gender sensitive software design, gender sensitive media didactics, diversity concept

The Gender Concept

Gender as a category originally was used to separate it from biological sex. Gender shows the socio-culturally constructed side of "Geschlecht", which constitutes itself in social interaction within social processes, in the body perception, and also in technical artefacts. In a broader sense it means all the conditions of relations between men and women.

Recently it has become obvious that sex and gender cannot be isolated from one another, that there is a mutual interaction between sex and gender. The German word "Geschlecht" is more adequate to reflect not only the obvious, that sex as a differentiating entity allows the construction of gender differences, but also conversely. The activity of mirror neurons as well as the whole nervous system compacts and even materializes individual experiences, and therewith socio-cultural norms.

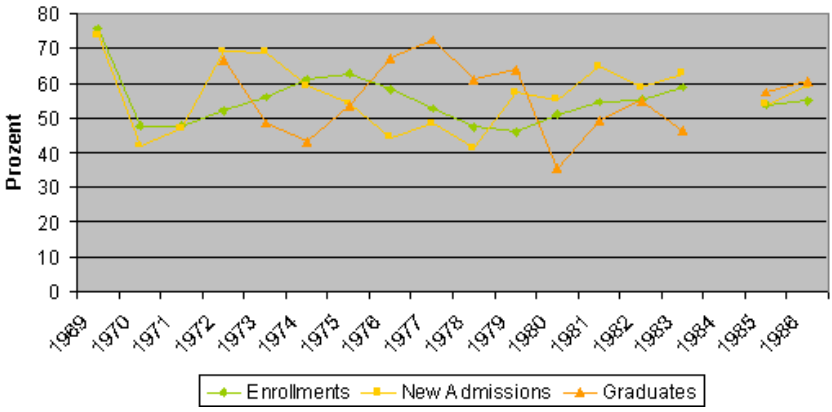
Gender as such does not presuppose concepts of maleness or of femaleness: Instead the questions are raised, who thinks what about the meaning of being male or female, how people perform and set themselves in scene as men and women, and whether such roles are variable and how can and should they be changed.

In this context the relation of gender and technology is of particular interest. In north-western European and American countries the link between rationality, science and technology with maleness is traded since early renaissance. It is still present in a symbolical "gender load" of technology (Crutzen, 2007), through the so called co-construction of gender and technology (see e.g., Berg, 2003). By this we understand that technology and gender as social achievements both constitute them mutually, both change in history, and are both free for interpretation and variation by individuals. The contingency of gender and technology and their mutual relation gives possibilities for active and conscious change.

Doing Gender within Societies

Gender is being done everywhere and all the time. The recognition of gender is immediate and the sense of respective differences and their use is almost ubiquitous (Remmele *et al.*, 2008). It seems that there is an urgent desire within societies to construct male/female distinctions all the time and always anew. We do not discuss here the desirability of societies with or without gender distinction (androgynous societies), but only distinctions which hurt one or the other group of people. It may well be desirable to doing gender in non devaluing, non hierarchizing ways, also in technological contexts, but this is theoretically even more complicated.

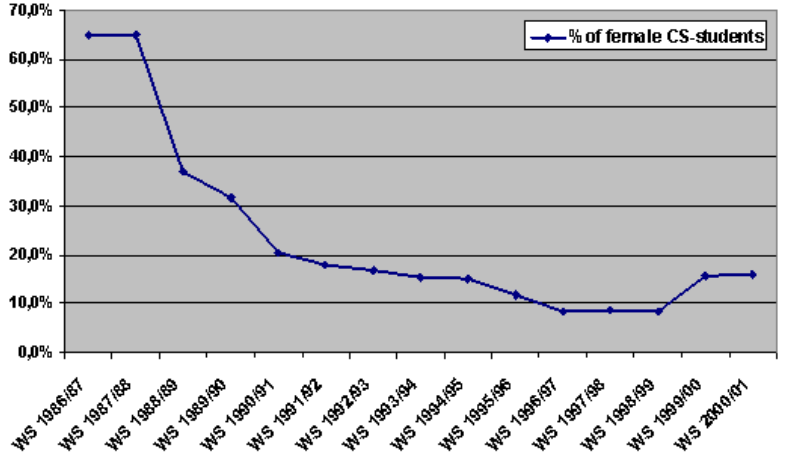
Gender is done differently in different places and at different times. In particular the gendered attribution of competencies and the consequent representation of men and women within professions differ greatly through time and culture. This holds especially in technological and scientific professions, where for example the participation of women in study courses of compute science varies not only through time: within Europe the Latin and the Slavic countries have much higher proportions than within the Anglo-Saxon, Scandinavian or German speaking countries (see e.g., Schinzel, 2007). The latter have the lowest fractions of women within the world, except for Japan. Also capitalism seems to be gender advert, as can be shown in many of the former socialist countries, especially within the new countries of Germany:



Source. Dolores L. Augustine (1999), and private communication, grafics © by B. Schinzel

Figure 1. Women in Computer Science (Informationsverarbeitung) in the Former GDR

In the former GDR around 60% of the computer science students were female, first by state coordination, later on free will. After reunion of Germany not only fell the female participation but also raised the male rate greatly. This for many reasons, two of them, because the newly constituted job market in the IT-filed did not absorb women any more, and because child care was abolished. The following graphics is representative for the situation in computer science at all universities in former GDR (Schinzel, 2007).



Source. TU Rostock, grafics © by B. Schinzel

Figure 2. Effects of the Reunion of Germany on the Female Enrollment in Computer Science at the Technical University of Rpstock

East Asia and South East Asia shows higher female (around 50%) parts than all European and North American countries, whereas in Australia and New Zealand the high participation of Asian students raises the female quota. Of special interest are the Arabic countries, where there is a female dominance in studies of computing in general, I. Al-Saedi (personal communication, December 17, 2008) today 90% in Iraq and 70% before the second Iraq war, 74% in Kuwait and Saudi Arabia, 40-50% in Egypt M. E. Khalifa (personal communication, October 19, 2007); N. el Gayar (personal communication, October 19, 2007) mentions that the number of female professors in Computer and Information Sciences is more the double the male ones, although the emeritus professors are only males, and so on.

Motivations for a Higher Participation of Diverse Groups of People, Especially Women, in the IT Development Process

The special one-sided population developing software leads to IT-solutions which often are inadequate and erroneous. This holds not only with respect to design, facilities, and user interfaces, but also in general for the whole architecture. Within the most contingent process of software development, e.g., the requirement engineering process leading to the software specification would need methods from the social sciences, but this is not professionalized in an adequate way within the formal sciences with their "objective methods". Consequently software engineers follow their own special knowledge and presuppositions about the world, their preferences of usage and needs. This is called ego-approach or I-methodology (Rommes, 2002). Parts of organizational and work requirements may remain invisible for specification and then are not included in the code. This holds especially for the Open Source community and the development of source code open software under the GNU public licence, where the developers' population consists of young white western males and female participation, e.g., according to a study 2002 ranges around 3%. User friendliness is hardly a concept in this community, with software written for skilled users, that is for themselves.

Contrarily to such attitudes the demands from industry or organizations on software quality are to regard software less as a product but as service and its production and reviewing processes as service deliveries (Ruiz Ben, 2007). With this positioning of software the mere respect of techno-mathematical aspects cannot be justified any more, also the outer shells touching user and the social have to be professionalized by computer science and have to become quality aspects of at least equal importance.

A greater diversity of people developing software and their intense communication among themselves, but also with users would help making software more adequate and usable. The inclusion of more women in the software development process automatically changes the

working climate and also invites men with more diverse orientations, in general people with other cultures and backgrounds into these jobs and communities.

Gender Relevant Aspects of e-Learning

A lot of studies have shown that a close look on the effects on gender of all settings designed anew by e-Learning is necessary (see e.g., Liao, 1999; Schinzel & Ruiz Ben, 2002). We group them into the categories resources, self concepts with respect to computers, attitudes towards technology and their use for learning, and then turning to the constructive side of design: Learning styles, content, its organization and its representation, communication possibilities and styles, and navigation possibilities and styles.

Barriers against successful e-Learning can be built up simply by lack of resources, such as time and costs for owning quick and elaborated computer equipment and internet access, as well as by lack of technical, computer and media competence (Ruiz Ben *et al.*, 2002).

Individual self concepts and attitudes in relation to computers and technology can serve as barriers as well. In north western industrialized countries the symbolic connection between technology, power and maleness can influence the symbolic attribution of dichotomized gender roles with respect to competencies, orientations, habitus and lastly also the representation in professions. As a result of this attribution in general women and girls are less self conscious and regard their performance as less than men generally do. Psychological studies show that women more often attribute failure more often to internal causes and success more likely to external chances, males often conversely (see e.g., Dickhäuser, 2001). In these cultures gendered self concepts and attitudes towards computers could be observed already with children and the gendering is strengthened during puberty. Although male and female students are using the computer equally for their studies women often consider themselves as less qualified. Also in a South African study amongst first

year Computer Science university students, male students had significantly higher self-efficacy than female students and predicted higher marks, but there was no difference in their actual marks. (Galpin *et al.*, 2003).

In his large and methodically well founded psychological study of computer use in schools and universities in Germany Dickhäuser found that (gender) differences in computer use and the selection of computer courses arise from a combination of the height of the subjective expectation of success and the expectation of its value. Additionally in other studies it was shown that in relation to very different subjects male students were attributing significantly higher value to computers than female ones (Foreman *et al.*, 1997).

Weaker embedding of information technology into everyday practice, both with respect to practical experiences and as communication themes leads to a lower validation of the necessity of computer use and competence and to lower self expectations with respect to computer handling.

Together this results in a vicious circle of technical barriers, lack of experience and negative self concepts. Conversely higher self expectations also lead to more experience and computer related communication with the respective positive circle.

In focussing on gendered attitudes towards computers and learning styles studies pointed out that more men are interested in computers as such whereas often women are using the computer as a tool. It is also "folklore" that task orientation and the wish to understand first before turning to the computer are preferred women's style, whereas game playing and an explorative style are rather attributed to men. In fact it has been shown in the European SIGIS-study that often gender behaviour is much more complex and that these stereotypes are not to be generalized to all women and men. Considering learning styles S. Herring (1996) favoured "connected learning" against "separate learning". Guess which of these styles in folklore is attributed to which gender! Using the possibilities of the new media in e-Learning group learning is an

important method for experiencing and training connected learning.

Although gender differences can be found, specific attitudes and styles cannot and should not be attributed to one or the other gender, because these are variable within one gender through time and space. And an attribution fixes certain behaviours and reproduces them through self fulfilling prophecy. Taking other categories and leaving gender at the best as secondary variable can help to find a deconstructive strategy.

I would like to demonstrate this using communication and cooperation styles (see e.g., Meßmer & Schmitz, 2004). Both in face-to-face and in computer mediated communication it was observed that men overall take longer time for speech and speak more often than women, that men tend to make more advert and provocative statements, whereas women more often tend to refer to and support previous statements, to hold up the communication and keep up relationships. There seems to be no gender difference in introduction of new thoughts and ideas into the discourse. Within the invisibility and anonymity of cyberspace the attraction of attention is even more important, with the effect that the differences in communication mentioned are making women more invisible within the net.

Turning to more refined investigations (see e.g., Herring, 1996) it could be observed that gender effects in online communication are influenced by the gender mix of the group, i.e. the more women the more differentiated their behaviour and the less dominant men are behaving; the amount of anonymity, i.e. the more anonymous the communication setting is the larger gender differences tend do be. Moreover the rank of professionalism influences the communication attitudes, i.e. the more professional the participants are in the communication context the lower gender differences can be observed. And finally the capability to reflect on communication tends to abolish differences in communication styles, i.e. the higher this capability the lower are differences. It follows that communication styles depend strongly on the context and therefore a deconstructive theory in gender studies and the respective diversity practice are adequate for gender

sensitive design and settings.

Another example for refined theory and practice are the navigation styles in cyberspace. In real space gender different strategies have been observed (Schmitz, 1999): Women tended to orient themselves more on landmarks and men more often used survey strategies and predefined routes. But there was no difference in the quality of performance.

The question arises whether such diversified preferences also occur in web navigation. In our competence centre[gin] (Gender Studies in Computer Science and Science) we investigated in this question (Grunau, 2004, Schmitz, *et al.*, 2006). It turned out that there are lots of interdependencies between navigation style and other categories of new media use. For given renouncement and navigation tool navigation strategies and competencies strongly depend on learning styles, media competencies and navigation strategies in real space. There were no gender differences in performance, but impacts of previous experiences, as well as of the kind of questioning and posing the renouncement.

Again it was shown that diversification of the categories observed and putting gender into the background allow for telling better tales. Such the stories of gender differences which bear the danger of imposing hierarchies, of competence or incompetence, can be replaced by talking about historical, background and contextual settings as causing differences instead.

Undoing Gender in e-Learning Processes

For meeting the great variability and context dependencies of behaviour in using the possibilities of the new media, diversity is the theoretical starting point. In practice this results in diversification to deconstruct gendering and gender differences in technical areas (Meßmer, 2004). A lot of categories for diversification can be considered in e-Learning: First the different subjects contributing to e-teaching and e-Learning, like pedagogy and didactic concepts as well as media didactics ranging from instructionistic learning, constructivist learning,

blended learning, learning by doing to collaborative learning. Also the different subjects' cultures, gendering, languages, stories told, leading examples and metaphors, didactic cultures and media didactics are relevant diversification categories. From the technical side the design of platforms and systems, their functionalities, access, designability and usability come into play and they can serve diverse teachers and learners backgrounds, goals, and wishes. With the technical mediation gender-technology relations influence design and reception of the teaching.

There are essentially three groups of people concerned with e-Learning. In sequential range these are first the developers of technology as well as the developers of the teaching and learning contents and the web-design. The second group, the teachers and tutors, have to select the technical means, must prepare the selection and organisation of content and define the media didactic concepts as well as the timing and support. To this aid they have to anticipate the full diversity of the third group, the learners, with their different backgrounds, pre-knowledge, media experiences, motivations and values, learning goals and interests, learning- and communication styles, and so on. All three groups bring in their socializations and gender stereotypes.

At first gender different work separation in these projects, like technical development as a male and content as a female work, should be avoided.

On the other hand a gender separation of students' work in computer rooms, e.g., by distributing different times for computer use, is a concept to avoid gendered work separation at the computer. Women have better possibilities to learn to handle the computer by themselves if they cannot be "helped" by friendly men. They also avoid the assistants' role in sitting together with men on one console. This also helps female students in minority position in techno-scientific subjects to build groups, socialize and exchange experiences, i.e., it works against isolation.

Designing gender sensitive e-Learning platforms is a challenge with many theoretical and practical difficulties. On the one hand the assignment of diversity longs for a lot of functionalities and integrated

tools. On the other hand meeting this requirement can lead to overloaded systems with poor usability and high demands on technical competence. Crutzen (2004) therefore proposed to dissolve the dichotomy between development and use. All software developers are also users and users also should be considered as designers of their working task. Therefore parts of the technological design should be left open to the users for interactive adaptation. In [gin] mentioned above we overtook this idea and are developing a learning platform (ModUS: Modular User-Oriented CSCL-System), which allows both diversity and participation (Meßmer, 2004). It relies on the concepts of modularity, scalability and flexibility. Modules can be used or abandoned in order to hold the screen small and not to make the platform confusing (a previous version with the same concept: "eGOware" has been used already for years). The platform follows (semi-)constructivist media didactic theories and it supports communication and cooperation, not only between teachers and learners, but also between the learners. The modularization is not only what is visible on the screen, but it is also performed on soft- and hardware-side, making the system slim and quick. This is what we call scalability. Flexibility is also possible concerning different browsers and technological formats. Also a content management system meeting the same requirements is under construction.

The use of the new media in e-Learning is a possibility to reorganize a lot of knowledge, competence, and didactic concepts. The way of organising information and knowledge is changing from linear to hypertext-like or even netted structuring. Interactive study forms, like seminars, project work and cooperative writing are enabled. e-Learning is mostly useless for frontal instructionistic forms of teaching. Bidirectional forms of teaching are mainly used in the humanities, whereas in technical and scientific subjects often unidirectional lecturing is the main form (Münst, 2002). As the interactive and collaborative forms are often preferred by female students (Schinzel *et al.*, 1999), and contrary to presuppositions also serve male students for better learning, also in the "hard" subjects, such forms of study should be used not only at school,

but at least in more advanced levels of university education. These forms also work against implicit and explicit hierarchizations through the teaching process and the interactions within, if not artificially introduced therein. For teaching diversity it is necessary to get away from deterministic viewpoints and the technological "one best way" thinking. In technical subjects e.g., alternative solutions and not only the seemingly unique correct or optimal ones should be presented. For example, in computer science even for algorithmically optimal solutions in context of applications there exist alternatives, e.g., of the definition of data structures and the modelling.

For the preparation of e-teaching content can and has to be organized in new ways, serving the necessities of web representation and using the possibilities of access to the huge text and data sets available in and through the net. The content prepared anew has to be modularized and represented serving the media technical, the media didactic and the gender and diversity requirements, all of them not only intertwined, but also heavily context dependent.

Considering the representation of content it is important to pay attention to a gender adequate language. Layout organization in space, the colours, logos, script, and signs, as well as icons, images, and visualizations have to avoid gender stereotypes, in order to avoid serving one sided interests and over generalizing normalization. In fact, in visualisations and animations mostly men are presented in diversified situations and professional roles, whereas mostly young slim lightly dressed inactive women are shown (Münst, 2002; Allhutter & Hanappi-Egger, 2005). In contrast also women should be shown in diversified professions and activities, age, habit us, dresses and beauty.

The same kind of respect has to be given to gender adequacy of paradigms, metaphors and leading examples. It is also important to be able to look upon the content from different and interdisciplinary viewpoints (see e.g., Wiesner, 2002) and to change media for serving different learning styles.

Content selection, its modular ordering and the ways of access made

possible are gender sensitive tasks, as well as the aids for overview and navigation through the content. As there is no "optimal" navigation support for navigation and overview again many possibilities should be provided: For first overview and initial learning hierarchical navigation tools like pull-down-menus may be adequate. For further learning net forms, like concept maps for overview, and topic map for web representation of ontologies and other network organization tools are to be preferred (Schmidt, 2004).

Whichever of the possibilities for the categories mentioned to be used for good practice cannot be fixed, because of the great context dependency which appears in concrete situations and for different groups of people. Therefore in [gin] we are developing content modules for teaching in Gender Studies in Technology and Natural Science for which the concepts of modularity, scalability and flexibility are also realizable with software support. Structuring, integrated wikis, navigation using concept maps, and context dependent use are under construction for collaborative learning (Meßmer & Schmitz, 2007).

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