ISOLATED EVENT OR WORK-IN-PROCESS; implementing gender perspectives in engineering programs

Karin Wiklund, Karlstad University, Sweden

Presented at Gender and Power in the New Europe, the 5th European Feminist Research Conference

Background

Gender science is a subject in programs of engineering at Karlstad University since autumn 1999. The idea originated from a project in 1995, which aimed to raise the amount of applications from women to the engineering programs. A University Board decision in 1999, which made gender perspective in education and research part of the university quality plan, strengthened the motivation to introduce this special course. The one-week gender science course is part of an altogether ten week introduction presented to new students of engineering. The intention is to make the students attentive to the ways construction of gender can be seen in technology as such as well as in the profession of engineering.

Female teachers from the department of gender studies have performed the teaching. The course is based on feminist theories, especially emphasising technology and the construction of gender.

The course was first introduced in one program without any reported special student reactions. But the reactions were very strong during and following the lectures when the course was performed in a wider context for the first time in autumn 1999. Male and female students protested actively during the lectures, telling the teacher to prove what she was saying, questioning the theoretical base and the teacher’s motives, and ridiculing person and performance. The reactions were much stronger and quite hostile compared to common reactions from “ordinary” students of gender science. Gender science reveals hidden structures and uncomfortable facts, and reactions like hard discussions and even depressive moods are often seen among students of gender science as well. But this was different.

The following three years of teaching gender science to new groups of students of engineering have been used to get a better understanding of this special teaching situation in order to improve communications with the students and reach a positive learning situation.

It seemed important to focus on the classroom situation and students reactions. But it also seemed important to get a better understanding of the context in which these courses were performed. To what extent was the question of gender perspective an integrated part of the engineering programs as such? We had seen the student’s reactions - but to what extent were leaders and teachers in those engineering programs familiar with and using a gender perspective? Was the gender study course an isolated event or had the implementation of a gender perspective become a work-in-process in the engineering programs, which was the intention when the University board decision was made.

The gender study course

The program which initiated the course the first time focused on energy and environmental care. Pedagogy had for some years been of great concern for the leaders and teachers of this program. The thought of a gender science course seemed to be accepted as a natural part of program development. No obvious reactions were seen either from other teachers in the program or from the students.

Other parts of this ten week Introduction course were group psychology, history of ideas and learning, mathematics, and sketching. The intent was to integrate especially group psychology, history of ideas
and learning, and gender science. Change of teachers and lack of planning resources has made it difficult to perform these plans so far. The different courses are still rather separate.

Eight programs of engineering has after that chosen to have this course as part of their introduction. The gender science course has since the beginning been performed during one week. A two hour lecture to all students was followed by two hour group sessions. Each group consisted of 6-8 students, both men and woman. Four groups had parallel sessions, with the resource of one gender science teacher for guidance during group discussions. This was repeated during three days, which meant that each student met the teacher during six different occasions, altogether six hours of lecturing and six hours of group sessions. The course was examined through an individually written paper, where the students showed that they had studied the literature and could use gender science theories on some observations of daily life.

The literature was an anthology, where well-known Swedish gender science researchers described the connection between gender, science and technology from different angles.

The teachers were all woman. Altogether five different teachers, most of them with a scientific background in social science and from the Centre for gender studies, have been involved in the teaching of this course.

The participating programmes of engineering

The program for energy and environmental care was the first to introduce the gender science course in its program. More programs followed. In the autumn of 2001, when the classroom study was performed, nine different programs had the gender science course as part of their introduction. These programmes focus on building, machinery, electronics, programming, computer science, innovation and design and computerized geographical information. The students of these programmes study three years to become engineers. The ninth and last program is four and a half years long and results in an exam as civil engineer in information technology. About 250 students participate in the programs.

Although the amount of female students varied dominance of male students in the programs was generally strong. The programs of Innovation and design and energy and environmental care had 50/50 % male and female students. The share of woman in the other programs varied from 20 % to none at all.

How the study was performed

The study has been performed by one researcher during a period of three years. The researcher is one of the teachers in gender science and furthermore director of gender studies. Each step has been inspired by and based upon the results of the step before, making the research process a continuous road of discovery. Following well defined steps can be identified:

- A classroom observation study was performed during the autumn of 2001
- Leaders from the engineering programs were interviewed
- Feminist pedagogy theory has been studied
- These steps resulted in a remodelling of the gender study course
- The remodelled course was performed during the autumn of 2002
- A student questionnaire was performed during early spring 2003
- A teacher questionnaire was performed during late spring 2003

The classroom observation:
The gender science course is now part of nine engineering programs; all with separate teaching schedules during a ten-week period. This made it possible for the researcher to make a non-participant observation study including all the programs. The researcher followed the gender study lectures, sitting in the back of the classroom. The observations focused on communication, verbal and non-
verbal, between teacher and students, and between students, and from a gender perspective. The performing teacher had been informed of the study, but the students only knew that an extra teacher was "sitting-in" during class. Classes with a total of 250 students, lectured by a total of three gender science teachers, all female, were observed. The proportions of men and woman among the students varied from no woman to classes with fifty-percent men and woman. The same patterns of communication could be seen independent of gender proportions or teacher at hand.

Leader interviews:
Program leaders were interviewed about the programs in order to get a better understanding of the context students were introduced to when coming to the university. Is was soon obvious that while everybody were anxious to make female students feel comfortable enough to both begin and stay in the programs, it seemed as is if most leaders were as ignorant as the students were when gender science was concerned.

Study of feminist pedagogy literature:
An intense study of feminist pedagogy literature followed. This included a general search for basic theories, as well as a search for examples like the one I and my colleagues had experienced. Swedish based literature, books and articles, was found to be very scarce. And even if there was an amount of international litterateur and examples concerning feminist pedagogy as such, very few books and articles covered the specific situation of teaching gender science to men and woman in a male dominated area. The search for literature gave me some very useful tools for a basic understanding. But it also showed that further research and discussions concerning this specific area were necessary for deeper understanding.

Remodelling of the course:
The course is still based on feminist theories with a focus on technology and the engineering profession. But although with a firm theoretical base, focus now lies on students own experiences of a gendered practice. The description of gendered power structures is given as an explanation and answer to students questions, not as a lectured "fact to be accepted". Lectures and group discussions are built on dialog, involvement and recognition. Literature has been changed to books and articles with a less pronounced "social scientific" language. The former individual examination is now a group examination, where the same groups work together through course and examination, giving the students a possibility to get to know each other and feel more safe and secure in discussions and performance.

Performing the remodelled course:
The remodelled course was tried out for the first time during autumn 2002. While the researcher had been the passive observer in the back of the class-room during the autumn of 2001, she was now again the active teacher in most of the programs. The change of atmosphere in the classroom was dramatic. Occasional attempts to ridicule the teacher or dominant the room still occurred. But earlier signs of deep frustration and hostility among the students were gone, replaced by curiosity and open discussions. This did not mean that the students, either male or female, all agreed with teacher and subject. But they listened and tried to understand.

Student questionnaires:
An evaluative questionnaire was given to the students four months after the course was finished. The researcher visited the different programs during their ordinary classes, with a permission from their teachers to let them use ten minutes to fill in the questionnaire. This means that those who answered were a random selection of the students, the selection depending on who attended the class this special day. 140 questionnaires were answered, 30 female and 110 male students, representing all programs. The main intention with the questionnaire was to get the students individual evaluation of learning during the gender science course, as well as their opinions concerning the importance of this knowledge in the programs as well as for their future carriers.

Teacher questionnaire:
The main intention with this questionnaire was to get a better understanding of to what degree a gender perspective was an integrated part of the teachers knowledge, planning and performance. How big was their knowledge of gender science? How much did they know about the gender science course? Had they met any reactions among the students as a result of this course? Was it common or not among teachers and/or students to initiative gender related discussions? Did they have a gender perspective in their own choice of literature and teaching? Did they find gender science to be of any importance as part of the program? Was this an important knowledge for the student’s future profession? And finally: did they as teachers see differences between male and female students concerning background, knowledge, performance or otherwise (to be defined by the teacher him/herself).

The selection of teachers to ask was made by the leaders of the programs. This resulted in 31 names, 7 woman and 24 men. The questionnaires were sent to the respondents by mail, and were resent to the researcher the same way. Three male respondents were impossible to reach in this way, and were excluded. Two mail reminders resulted in answers from 17 teachers, 5 woman and 12 men.

Both students and teachers had given an amount of comments, personal explanations and clarifications. The materials have been examined and analyzed through quantitative (computerised statistics) and qualitative methods. Teachers and students from all the programs were among the respondents.

Results

Student reactions before and after remodelling the course

Three combinations of relations could be seen in the classroom during the classroom study in autumn 2001. Those were teacher/male student, teacher/female student, and male students/female students. Age did not seem to separate in itself. Reactions from younger and older male students differed slightly in strength, but not in structure. A more evident difference could be seen between younger (twenty years of age) and older (forty years of age) female students. Many older female students identified examples and theories from their own personal experiences. This recognition was shared with the teacher more often in pauses between lectures than during lectures.

Men and woman placed themselves in separate groupings in the classroom. They hesitated in the doorway and looked around the room searching for a place beside a peer of the same sex. Chairs right in front of them could be rejected for a seat in the far end of the room but close to the other men or woman.

Both male and female students performed dominant strategies towards the teacher. The teacher was interrupted by laud comments on reliability and origin of theories and examples. Theories were individualised: "This is not true in my family, I have never seen anything even close to what you are saying!" "I have never had any problems as a girl. This is only relevant for your (older) generation!"

The reactions from the male students could be sorted into three categories: attitudes of defence, aggressive attacks, or fragments of thoughtful reflection. Aggressive attacks were more common among groups of young men. Older male students, often with families of their own, showed defensive mechanisms but no open hostility. Relevant questions and discussions were rare. But they did exist, and mostly on an individual basis. When asked those students revealed earlier knowledge of gender science in one way or the other (family, social science courses).

The most common reaction from female students was silence. Aggressive attacks did exist, but were then performed by young female students on an individual basis. The female students protested against the teacher’s description of gendered power structures of society which showed woman, including female engineers, to be in a subordinate position when professional possibilities and salary levels were concerned.
The relation between male and female students in the same class was especially interesting. When female students tried to ask questions, or start a discussion, fellow male students often stopped them. Male students could be just as aggressive towards their female fellow students as they were against the female teacher. After trying to get into the discussion a couple of times, many female students silenced. But the opposite could also be observed. In some classes you could see a natural "democracy", male and female students sitting together, interested discussions, female students talking as much as male students. This did not mean that the students accepted what the teacher said. But neither the teacher nor the female students were openly attached or silenced. It seemed as if male attempts to aggressively dominate the classroom area were more common in engineering programs with a stronger male tradition (machinery, building) than in those with a more cooed tradition (design, energy and environmental care).

After remodelling the course student's own definitions of how male and female identities were constructed were collected through short questionnaires before the course. A report of their own answers introduced the first lecture, causing much laughter and recognition from both male and female students. This started a dialog between teacher and students. The students thus described what a gendered society looked like, and the teacher gave the students the gender science theories that explained what they saw. The change of atmosphere in the classroom with this kind of teaching was very evident. Occasional attempts to ridicule the teacher or dominant the room still occurred, but were eliminated by the other students. Group discussions were given much time. Each group had to produce a joint paper as an examination. The researcher followed most group sessions. The discussions and learning process seemed to be a connected knowing, described by Belenky and colleagues and defined as woman’s ways of knowing (Belenky et. al., 1986). Given the right circumstances it seems as if this might be men’s ways of knowing as well. To produce the examination paper groups had to meet and work together even after the course was finished. Ambitions to produce a good paper were often high. It even happened that male representatives from groups came to discuss certain questions with the teacher to be certain "to get it right". The course functioned much better, but far from perfect. But it seemed as if an important key had been found to how a course in gender science could be performed in a male defined area.

Leader interviews, student and teacher questionnaires
Discussions between program leaders and gender science teachers combined with a joint planning had preceded the performance of the first gender study course in the energy and environmental care program. Most of the other programs had integrated the course as a "package", without more than superficial contact with gender science teachers beforehand. The University Board had told them to do so, so they did. The interviews with the leaders revealed a wide range of variance when their understanding of gender science was concerned. It was also obvious that most of the programs functioned rather separately, especially since the programs belonged to two different divisions, division of information technology and division of engineering. The interviews showed that although everybody had the intention to do their best, separate academic cultures, insufficient knowledge of each others subjects, and lack of time and resources for communication and planning made it difficult to fulfil those intentions.

The teacher questionnaires confirmed this impression. Most of the respondents were combining the responsibility as teachers with a leadership for one or more courses in the engineering programs. Some of them were teaching in more than one program. The men had been working in the programs longer than the woman. There was an obvious and serious interest in responding to the questionnaire, which could be seen in long and engaging comments given to many of the questions, wither the researcher had asked for them or not. It seemed to be very important for the respondents to observe especially the female students situation, see special needs among both male and female students, and help students when necessary. They had a great ambition to be "fair" towards the students. Humanistic values in general and focus on gender equality were common.

But they had little knowledge of gender science, as well as why and how a gender perspective could be integrated in teaching and choice of literature. A surprising result was that a majority of the male
teachers thought that they knew rather much about the gender science course, while four out of five female teachers knew rather little. Their knowledge in feminist theories and feminist thinking seemed to be small. While many of them described situations in the classroom which for the feminist teacher revealed obvious gendered power structures, the program teachers did not seem to see this. While the female students often discussed with the teacher in order to really understand, most male students just accepted the same facts. The male students were described to dominate space and time in the classroom, while female students were described to be more ambitious, more careful and exact, and in need of confirmation. The teachers tried to handle this by giving the female students special support, not by changing the male dominance. Differences in behaviour between male and female students were more seen as complementary than as a sign of gender construction.

The differences between students when they started the program where described to be bigger within the sexes than between the sexes by a majority of the respondents. Many students of both sexes were lacking practical experience. A technological background and upbringing was no longer natural for either male or female engineering students.

It was very rare for both male and female teachers to use a gender perspective in choice of literature and way of teaching. Half of the respondents never used it, the other half on isolated occasions. Gender was discussed among teachers occasionally, slightly more often among female than male teachers. Teachers had met reactions among students on the gender science course, female teachers more than male. Students otherwise very seldom initiated discussions concerning gender of any kind. When asked if they thought that gender science knowledge was important for the students future professional lives, and if the course should be part of the program, female teachers found it more important than male teachers, and also found it more important to have the course in the program than their male colleagues. Two male teachers did not see any need of the course at all.

So far the teacher’s opinions. The students questionnaire was slightly less detailed and concentrated on the students individual evaluation of learning during the gender science course, as well as their opinions concerning the importance of this knowledge in the programs as such and for their future carriers. Their experienced learning was asked for only after the gender science course was remodelled. We do not know if remodelling has changed the experience in any way. But their answers after the remodelled course were a positive surprise to the researcher. 75 % of the female and 80 % of the male students thought that they had more knowledge in gender science after the course, half of those much more knowledge. Only around 20 % did not think that they had learnt anything. Some of those had good knowledge beforehand.

A majority of male and a strong majority of female students thought that it was rather or very important to have the course in the programs. Distinctly more female than male students found it very important. Some commented that it might be more efficient to have it later in the program, not as part of the Introduction. The realities of working life were then more close at hand. But about 40 % of the male students, compared with 10 % of the female, found the course without or with little importance for the program. Most of those male respondents came from programs with a strong male culture and few or none female students. Many more, both male and female students found gender science knowledge important or very important in their future profession as engineers. The impression was then that they did learn something during the gender science course, the knowledge was important in their future profession, but opinions were quite divided when it came to give this knowledge a place in the programs.

Like the teachers many students had found it important to comment and further explain their answers to the questions. When asked if they found it important if the teacher in gender science was a woman or a man, a majority did not find this important as long as the teacher knew her/his subject well. Some found it to be more confident if it was a man. More important was that the teacher did not involve any feelings, personal experience or feminist thinking. It should be presented in a scientific, not personal way. Some male students complained over the accusations they felt the teacher had brought against men, especially men’s wrongdoing against woman. Interesting enough quite a few female students
supported the feelings of their male colleagues. They found it important that the male students did not have bad feelings or were "blamed" for the presented gendered power structures. No male students showed the same concern for their female colleagues feelings.

Many students found it more important to be told what to do in order to change the current situation than focus on history and context. Group discussions had been very appreciated by both male and female students. It was very important to have both men and woman in each group to facilitate discussions. The course had given quite a lot of insight and knowledge, "made me think of things I did not see before" as a male student put it. Many female students would like to change the literature, since they found it too male oriented. Very few male students asked for this, and not for this reason.

**Analyze and discussion**

Teaching gender science involves consciousness-raising and focus on issues of gender based power differences. Based on feminist pedagogy it includes an aim to disclose and change current gender power structures through personal and political discussion of gender injustice (Fisher, 2001). Most literature concerning feminist pedagogy is centred round female teachers teaching woman. Men are not included, either as teachers or as students. It has so far predominantly been a female agenda (Fisher, 2001, Belenky et. al., 1986, Flannery, 2000).

There seemed to be a deep collision of academic and scientific cultures between gender science and the technology oriented engineering programs. There was also a contrast between gender science, identified as a female project, and engineering, defined as a male area. A female teacher with the right to make male students listen, and with the power to examine the course, seemed to be a provocation in itself (Camack and Phillips, 2002). If you are seen as "too" feminist student response can easily go from discussing values to value the teacher (Clark, V.Garner, S. N., Higonnet, M. and Katrak, K. H., 1996). Even after remodelling the course student reactions towards the content of the teaching followed a well-known pattern of denial, discounting, distancing or dismay (Titus, 2000).

Teachers and students are independent as knowers and learners. (Lyons, 1994, Ropers-Huilman, 1997). According to Lyons, teachers and students influence and are influenced by each other's ways of knowing. They are nested knowers, and thus dependent on each other in the learning context. In order to understand the teaching situation three elements of the dynamics of the epistemological interaction needs to be paid attention. These are; teacher’s stance towards the self as knower; teacher’s stance towards the student as a knower and learner; and teacher’s stance towards knowledge of a discipline/subject matter in the interaction of learning

The subject of gender science is based on feminist theories. This means that the assumptions for all gender science teaching is to reveal gendered power structures in society, including family, work, education and economics. To see and integrate those assumptions of hidden power structures is a many times' painful process, which deeply influence how we see ourselves as male or female. While the teacher of gender science has grown to see and accept those assumptions, it might be total news to the student in front of her. A learning process, which might have taken a lifetime for the teacher, is presented to the student during a week. Furthermore many feminist teachers are deeply identified with their mission as feminists. If not reflected upon it might create difficulties in communications with students.

The resistance can be seen as a discourse of struggle lying at the heart of any critical pedagogy (Hughes, 2002). Educators are not supposed to colonise, they are supposed to open up possibilities. Interpretation can not be controlled. Ways of teaching and choices of literature aim to give the student certain knowledge. If we transfer this statement to our students of engineering a more thorough adjustment to their familiar context might facilitate their understanding. Involvement and recognition is an important part of feminist pedagogy (Fisher, 2001). It means drawing on experiences and
feelings in order to be able to challenge our different perspectives. But this might also bring private situations to the surface, especially in group discussions and calls for strong ethical judgement when the learning situation is planned. Welch describes the principles of feminist pedagogy in this way: do not dominate, do not humiliate, do not indoctrinate. What is important is to strive for egalitarian relationships in the classroom, try to make all students feel valued as individuals, and use the experience of students as a learning resource (Welch, 2002).

Revealing gender in technology and its consequence for their coming profession caused disturbance to both female and male students. Engineering is a male defined and dominated area (Wajcman 1991, Cockburn and Ormrod, 1993, Salminen-Karlsson, 2003). This means that your manhood is acknowledged if you are a male student, while female students strive to assimilate to the hidden norms which also mean denial of traditional femininity (Dryburgh, 1999). Assimilation is a one-way-process, while acculturation is a two-way-process, where both parties change into something new (Martin, 1999).

The results give us a picture of ambitious, disciplined female students, many of them living as a minority among sometimes dominating male colleagues. Oppressiv behaviour was common towards female students, seen both in the classroom study and described by teachers in their comments in the questionnaire. Although obviously silenced, no female student talked about this. It was accepted to talk about gender equality in general, and in relations to gendered salaries in group discussions. But gendered power structures were not to be discussed, either by woman or men, students or teachers. On the contrary; both teachers and students commented that it was important that teaching was objective and not feminist, and that men were not to "feel guilty" or "accused". Talking about gender equality was accepted, explaining the lack of this equality through feminist theories was not.

What neither the teachers nor the students seemed to have understood is the meaning of a feminist based teaching. The aim is consciousness-raising, to reveal gendered structures, in order to change them. Fisher describes a similar situation in this way: "Feminist teaching, too, concerns issues of power. To call myself a feminist teacher implies a claim that certain relations of power are unjust. It implies that I will use my power as a teacher to place certain topics and readings about injustice on the agenda for classroom discussion. Every time I say feminist, students know that they will have to address inequities of power" (Fisher, 2001, p.35)

The male defined culture with its gendered power structures, make it necessary for female students to adjust to this culture in order to stay. They are the ones that do not fit in, and assimilation is their only realistic solution. Henwood (1998, p. 45) means that "the discourse says that ´engineering is man’s work´ and ´woman can be engineers, too´. This contradiction can help explain the limited nature of many equal opportunities initiatives, the confusion and conflict experienced  by many woman studying in non-traditional subject areas and the reluctance of these woman to discuss the problems they face".

This fact is not seen or problematised by the teachers in the programs. "I try to stop them from being so ambitious" as one male teacher puts it. But he does not ask why this ambition seems to be so vital to those female students. The teachers are very observant on students needs, both male and females, but do not seem to do anything to actually change the gendered classroom situation. Female teachers and female students find gender science knowledge to be of greater importance for the profession as engineers and as part of the course than their male colleagues. Female students protest against course literature since it focuses on engineering as a male defined area. Male students complained about the literature as being too much focused on social science, difficult to read and understand. The male defined context was not a problem.

Changing the male defined engineering education to more gender neutral would be a way out of this dilemma. So far this possibility has been appointed, but not made a reality (Volman and van Eck, 1995, Salminen-Karlsson, 2003). The gender science course can actually be seen as part of the reconstruction of this male defined education. Teaching is given to male and female engineering
students for their future professional needs. The results from the teacher questionnaire on the other hand show that program teachers have very little knowledge of gender science, and lack a gender perspective both in choice of literature and in planning and performance of their teaching. A gender science course to the program teachers might be more effective in order to change gendered structures in the educative curriculum.

This might be positive not only for female students of engineering. The results show that there are more differences within than between the sexes when practical technological experiences were concerned. Practice is not an ordinary part of the engineering masculinity any more. Connected knowing, described as a specific way for woman to learn (Belenky et. al., 1986) seemed to be used by both men and woman during group discussions. Young men seemed to be trained listeners. There seem to be a diversity in thinking and experiences among men and woman of the new generation. Gendered power structures are still dominating, but the traditional hegemonic masculinity is no longer certain (Henwood and Miller, 2001, Connell, 1995). Young men and woman have different experiences than former generations, which could be seen during group discussions. Different kinds of masculinity can be identified depending upon the context (Skelton, 2001). The results of gender mainstreaming in our society at large can be seen among the young students. Gender science knowledge might thus be a useful pedagogical instrument for program leaders to see, understand and adjust to this situation.

The course in gender science, which has been part of the introduction in a majority of the engineering programs at Karlstad University, is clearly an isolated event and not any part of a work -in-process of implementing a gender perspective in those programs. In can be seen as a beginning, but much more need to be done before the intentions of the University Board decision of 1999 can be fulfilled. This is a question of resources and planning. More disturbing is the situation for many of the female students in those programs, which has been exposed in this study. The remodelled course seem to have changed the problematic situation for the teachers of gender science, even if the model still has to be worked on. The course still demands more efforts than other courses, and the teacher has to be prepared for all sorts of reactions. But when you know that this "is part of the game" in feminist pedagogy, it can be handled. The female teacher in gender science spends some weeks in this context once a year. The female students spend their whole university education there. The gender science course is a good beginning. But future research and activities need to focus on the whole context. A well prepared and fully performed feminist pedagogy might then be very useful, since "in essence, feminist pedagogy is based on the desire for social transformation. It explicitly seeks to dismantle the systems of oppression that collaborative learning leaves unquestioned" (Mayberry and Rose, 1999, p. 7). Acculturation of both men and woman towards an unbiased educative agenda must be the goal, not continuous assimilation of woman into a male defined profession.

References:


(New York: Routledge)


Author:

Karin Wiklund
Director of Studies, Center for Gender Studies
Karlstad University, SE- 651 88 Karlstad, SWEDEN
Karin.Wiklund@kau.se