

# Equal Opportunity in Higher Technical Education: Past, Present and Future\*

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*This article is a retrospective of 15 years of equal opportunity policy projects in higher technical education, and a consideration of the future thereof in the Netherlands. During this time the focus moved from a purely information exercise directed at girls to looking at the educational home for the cause. The latter initially concerned the didactical design of the courses, but now it also involves scrutinizing content followed by redesign of existing and design of new courses. Higher technical education is clearly on a new track that has tremendous potential. Nonetheless, a consistently integrated and expert approach is required.*

## INTRODUCTION

IN THIS ARTICLE we look back on 15 years of equal opportunity policy and related projects in higher technical education in The Netherlands and consider the future thereof. The reason for this analysis is the fact that VHTO, a national organization of women in higher technical education and positions and a center of expertise on diversity in technology in the Netherlands, completed the Technóva project last year. Within the framework of the Technóva project, VHTO assisted institutes of higher education that offer technology courses in mapping the equal opportunities in their institute; in addition, VHTO advised and assisted the institutes of higher education in the design and execution of a suitable intake and education policy from a gender perspective.

In this analysis we firstly give an outline of the trends and developments with regard to equal opportunities in higher technical education in The Netherlands over the last 15 years. Subsequently, current developments are discussed and the perspectives for the (near) future are examined. Finally, some equal opportunity projects of VHTO are described.

## DEVELOPMENTS TO 1998

The focus on equal opportunity (EO) issues at most institutes with technical training dates from the mid-eighties. At this time, a large number of institutes set up EO workgroups consisting of (female) teachers, student deans and in some cases, supplemented by students. Recognition of the EO aspiration as a separate policy field followed a few years later (in 1987) when VHTO submitted a request to the (Dutch) Ministry of

Education for two staff hours per week to be made available for EO coordination in institutes of higher technical education. One condition given was that the institutes also contribute two hours themselves. Half of the institutes with technical training courses accepted this offer and appointed an EO coordinator for the development and execution of EO activities. At the same time, technical universities also made hours available for EO coordination.

### *Improving information*

At the time, the uneven participation of males and females in technical education was thought to be mainly due to society as well as female students themselves. Preconceptions, doubts and insecurities, both with regard to their own abilities as well as actually studying and working in a technical environment, were seen as important obstacles against girls choosing a technical education. Against this background, the institutes of higher education and universities set out to actively improve the information supply, starting in the late eighties until well into the nineties. Girls were recognized as a separate target group. Special information activities were organized in order to reach the girls in secondary education and to show them that technology is broader and more interesting, not to mention closer to their living environment than they might think. The best-known example of this was the 'Do day' or the 'Girls day' for girls in secondary education. Almost all institutes of higher education with technology courses organized these days for many consecutive years. These were followed by information activities that were coordinated nationally and in which many institutes for education participated. Examples are a magazine called *Bits and Pieces* and the CD-ROM *Zapp!!* both for girls in secondary education and both about technical education and jobs.

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### Guidance

By the end of the eighties it became clear that better information specifically aimed at girls was not sufficient for getting an increased intake, retention and output of girls in technical education. Research showed that there was a negative relationship between the performance and study motivation of female students on the one hand and the social study environment in higher technical education on the other. In 1989, VHTO joined forces with the EO coordinators in higher education and presented a proposal for setting up a guidance system and changing the educational environment. A case was made for a systematic approach, among others in relation to work placement and the transition from education to work, as well as a policy with regard to sexual harassment. Attention was to be paid to (didactical) refresher courses for teachers in order to improve the atmosphere in classrooms. Furthermore, the opinion was that more female teachers should be appointed. The expectation was that they would function as role models for female as well as male students and that their presence would have a positive effect on the educational environment.

The institutes proved to be amenable to the advice and most institutes took action during the following years and applied measures to actually improve the guidance of (female) students and improve the atmosphere. The name given to these forms of information and guidance activities specially aimed at girls (shaped from a gender perspective) was *specific* EO policy and the role of experts and stimulating people in this field, like the EO coordinators, was beyond dispute.

### Policy development

During this period (1993/1994) these same EO coordinators pleaded for taking the next step. The specific EO policy that had been developed had to be embedded in the general education policy of technical faculties. A case was made for testing general policy proposals and measures against the EO objectives so that the EO policy could become a *facet* of the regular policy. It was also necessary however, that activities aimed at increasing the intake of girls in technical education were followed by activities aimed at the retention as well as the successful outflow of these girls.

The institutes with technical training courses took these recommendations seriously and asked VHTO for advice in the policy embedding process. Among other things, this resulted in the *Barometer* [1] in which trends and figures relating to female students in higher technical education are included and in a *Streefcijferscenario (Target figure scenario)* [2] by which educational institutes can determine realistic and well-founded target figures with regard to intake, retention and output of female students.

### Curriculum development

At the time, an important impulse in thinking about the relationship between women and technology was supplied by the report *Het mysterie van Thea (The mystery of Thea)* by the Dutch Emancipation Board (1994) [3]. In this report, the Board pointed out a number of fundamental pressure points explaining the lack of success in substantially improving the position of women in technology. The image of technology was one of the pressure points. The Board was in favor of a reorientation of engineering and technology: technology should once again be at the service of humankind and the demand for products (practical value) should be the determining factor for the development of technology. It was thought that a broad and emancipatory technology, aligned with the technical occupations and education, would be more attractive to larger groups of females and males.

The first practical translation of this line of thought was given in the VHTO memorandum *Innovations from a gender perspective* (1994) [4]. One of the core issues of this memo was the fact that the limited participation of girls in technical education has been approached too one-sidedly, as an information problem. Reform of the 'education product' from a gender perspective means, this memo argued, that the accent of the EO effort should no longer be one-sided and mainly focussed on information activities but that it should also focus on other fields of the education practice like curriculum (content) and process (didactics and forms of education). At the same time, the memo confronted education with the fact that 10 years of experience in EO processes in educational institutes had proven that an emancipatory innovation process can only be effective if a number of (pre-) conditions are met: simultaneous advancement of an EO infrastructure (one cohesive body of policy, organizational and financial measures), policy design and activities from a combined bottom-up and top-down approach, as well as working on operational, concrete and measurable objectives.

Based on the research results from VHTO's research *Vrouwen vergeleken (Women Compared)* (spring 1996) [5], a list of 'success factors' was compiled. Gender innovation of the curriculum means, among others:

- broadly orientated teaching material (not one-sidedly technical);
- integrated teaching material (subject contents refer to each other, interdisciplinary problem solving);
- context rich subject material (related to professional practice);
- attention to technology applications;
- diversity in teaching and learning methods (project- and problem-based education);
- attention to differences between students (for example, learning styles) by teachers;
- improvement of atmosphere and customs at

school and in groups (premises, study environment, teacher-student interaction and student-student interaction).

The conclusion that certain learning methods are more attractive to girls than other learning methods received further support in research conducted in increasing degree during the nineties on the possible differences between the way in which women and men actually learn [6]. In higher technical education, the discussion was expressly moving over to style and content of the education learning process, where the differences between (male and female) students should be taken into account. A complicating factor was the fact that teachers often offer resistance to specific measures for different treatment of female students. This also applied to many of the female students themselves, who do not wish to be placed in a position of being the exception to the rule. Besides this, there are large differences between the female students themselves. Another issue that had to be taken into consideration is gender stereotyping: statements made about the learning methods of women could lead to stereotyping that could work against them. It was therefore argued that the focus should be on *diversity* among students and that an effort should be made to embed attention for this issue in the then upcoming process of education reform and the implementation of quality care in higher technical education.

Supported by the experiences of the Scandinavian countries and the United Kingdom, more and more higher technical education institutes were introducing new forms of education like problem- and project-based education which should increase the appeal of technical education and have a positive effect on the intake, retention and output of girls and a different type of boys.

All in all, an established fact from the mid-nineties is that the management of higher technical education were convinced that a change of course was called for. Subsidy requests were then submitted on a large scale by many technical education institutes for changing educational practice and for communicating these changes to their potential target groups. This was the start of implementing project- and problem-based education.

#### CURRENT SITUATION (1998–2000)

We have sketched above the situation as it was in the fall of 1998, when VHTO started with the Technova project. Even though EO objectives were endorsed in higher technical education, an atmosphere of doubt was prevalent in many institutes regarding the realization of these objectives. There was tremendous willingness to put in the effort but a suitable method of approach was lacking. Many institutes had experienced that the

measures taken until then had been insufficient to bridge the large gap between girls and technology.

At present the tendency is not aimed at developing entrance activities especially focused on girls. There are various reasons for this.

Firstly, activities like 'Do days' have been a large success for a number of years now. This has led to a situation in which large parts of the methodology have been transferred to the general information activities, on the principle that 'what is good for girls is also good for boys'. The double effect of this has led to a gradual abolition of activities geared exclusively for girls.

A second important reason for the gradual disappearance of these activities stems from disappointment resulting from the lack of immediate return (increased intake in the own institute) from these activities. In the beginning of the nineties, the increased percentages of female intake was visible and the optimists thought that the percentage could increase to 30 or 40% within a few years and that the girls would be a welcome compensation for a posing threat in decreasing male intake. These expectations were too high. Even though the intake of female students decreased slightly less in the period 1986–1999 than that of male students (40% versus 47%), the participation of women increased less than expected: from 12% in 1986 to 14.8% in 1996.

However, important shifts have occurred in the technical education choices of girls. Of all the girls entering higher science and technology education about 65% used to choose a laboratory or chemistry education/course. At the end of the nineties this dropped to 31%. Girls are more spread out over a larger number of technical courses. Changes can also be seen in the preferential fields of female technology students. The decreased interest in chemical technology and laboratory courses has mainly benefited civil engineering courses and the fields related to this like regional planning as well as construction management, who have experienced an increase of 7% in their market share among female students during the past 15 years (from 6.4% to 15.1%) However, the biggest swing was to courses that hardly existed in 1986, which can be classified as 'interface or common ground studies' (combinations of two fields of study). This concerns courses like industrial product design, art and technology, informatics and information technology, aquatic eco-technology and commercial garment technology. For all five of these courses the same principle applies, that technology and technical knowledge are combined with other subject areas that girls find interesting. Together, these five courses realized a market share of 22.3% of girls in 1999, which means that almost one quarter of the girls that started a technical education in 1999 chose one of these five courses.

The third and maybe even the most important argument for discontinuing the separate activities for girls is the fact that the effect of better marketing and information were especially beneficial to

the intake in architecture and building engineering (buildings) and technical business management but not very beneficial to the so-called 'hard core' of engineering like mechanical engineering, electronic engineering and civil engineering (roads, viaducts, etc.).

New questions arise: Do girls let themselves be convinced, if the gap between what they find interesting and what technical education has to offer is so large? Do girls really not know what there is out there in the world of technology, as is claimed? After all, they appear to carefully define which fields of study are interesting and which are not. Even within courses or between courses in the same field of discipline, boys and girls make different choices.

A case in point is perhaps the difference in intake at two building courses in the same part of the country. The recruiting area of these two institutes overlaps partly and yet the inflow of girls differed by about 17% in 1999. The one course pointedly focuses on the structural side of construction; the other course accentuates its subject specializations in public housing and urban development. The latter draws more girls.

#### *New perspectives*

All of the previous has contributed to the institutes looking for new possibilities to enlarge the appeal of technical education for girls (and boys). As already mentioned, higher technical training institutes introduced problem- and project-based education on a large scale in the early nineties. The expectation that this would increase the appeal of higher technical studies for girls has partly been met. Many of those involved confirm that the new forms of education have made the position of girls stronger. The demand made on social skills in these new education forms is an important contributory factor. Girls often are better students, pioneers in work groups and willing to take on the responsibility for the group's performance. However, these educational reforms have alone not been the key to a larger intake, retention and output of girls and a 'different kind' of boys. More fundamental and integrated changes are necessary in the engineering courses.

#### *Integrated approach*

The Technóva project has drawn attention to the importance of the link between intake, retention and output right from the start. This fits in with the growing realization at the institutes that the connection is being missed at both ends. On the intake side it is obvious that the youth is less and less interested in the classical technical courses available. On the output side we find that society has different requirements now that the current traditional (manufacturing) industry is gradually disappearing from the Netherlands. Technology is establishing deeper roots in all sectors of society and a 'different kind of engineer' is needed.

Many educators and education managers in higher technical education are of the opinion that technical training is too 'limited' and that broadening and differentiation is required. However, it is also emphasized that not all faith should be pinned on the courses alone. Another issue that also or especially deters girls and many of the boys as well is the image of technical occupations and the technical industrial activity. In addition, the institutes notice that their efforts in the field of education reform are difficult to translate into course programs that are recognized as being different and more attractive. This shows up the limitations of 'loose measures' and at the same time, the necessity of an integrated approach.

#### *Redesign of courses*

Besides the fact that higher technical education is paying attention to an integrated approach, it is also busy with the redesign of courses. Broadening and repositioning of the curriculum is the challenge facing technical education for the next few years. From the perspective of a larger participation of girls, the exploration of the boundaries of technology is especially interesting.

It has been asserted that 'translation' and 'steering' jobs in technology, together with the education that educates towards this, are more likely to appeal to the interests of girls than the more traditional 'manufacturing' orientated education and professions. In general, it could be said that subjects on the edge of technology and the user, on the edge of technology and society or on the edge of other disciplines like health care or the arts are more accessible and interesting to girls. Participation figures of between 20 and 25% female students in the new training courses prove that females certainly orientate themselves towards technical education choices and are quick to recognize the new courses on offer as an interesting field of study.

#### *Diversity expertise*

As outlined, we see a definite change of insight into the problems and linked to that, a change in the efforts made to affect the intake of a broader group of young people, among them girls, into higher technical education. This larger *sensitivity to diversity* in higher technical education is an important achievement. Besides sensitivity, *expertise in the field of diversity* is also necessary in order to weigh up and make the right choices in the continuous process of redesign and renewal of education.

For these reasons, VHTO recommends the formulation of an explicit diversity policy and for diversity *agents* to be given a fixed place within higher technical education. These agents could be teachers in higher education who, in addition to their regular (education) tasks, are also competent in the field of diversity. For instance, they could help to formulate EO-related policy, take action to enlarge diversity sensitivity within technical

education and systematically measure and record what these renewal actions actually provide in relation to the different target groups. In a nutshell, higher technical education is clearly on a new track that has tremendous perspective. However, a consistently integrated and expert approach is required.

### IMPLEMENTATION OF EO PROJECTS

In this section we report on three recent national projects, by way of illustrating the way in which VHTO executes and implements EO projects with institutes of higher education.

- *Action*: the development of an instrument related to project- and problem-based education.
- *Mellow*: a mentor project.
- *Viking*: a guest lecturer project.

#### *Action*

VHTO took the initiative for developing *Action*, proceeding from the observation that the implementation of project- and problem-based education alone does not necessarily contribute to an increased appeal and practicability of technical education for female students. Such outcomes are also dependent on the extent in which a number of preconditions favorable to women are realized.

*Action* is a diagnostic and evaluation tool (also available in English) [7] that can be used by technical education institutes for developing, executing and evaluating new or existing courses or modules. The tool supplies the conditions that have to be met in order for the education to be considered excellent, as well as being appealing to female and male students. Indicators are given and a checklist, containing relevant preconditions and a number of checkpoints, is provided. An important spin-off from this initiative is the experience and knowledge transfer that resulted between institution personnel in the field of education innovation from a gender perspective. As this project belonged to the schools themselves and as they actively participated in the development, the tool was relatively easy to implement in the institutes concerned. Naturally the tool will be forgotten in due course but the way of assessing, from a gender perspective, is probably well rooted in the minds of some of the participants.

#### *Mellow*

*Mellow* gives information about the training and careers of engineers and supports the girls and women who would like to have an experienced female engineer as a mentor. This applies to scholars, students and junior engineers. In the Dutch national network of EO coordinators, which is organized by VHTO, it had been established that both young girls in secondary education and young women studying technology should be brought into closer contact with female engineers.

VHTO together with three institutes of higher technical education submitted a European subsidy request for setting up a mentor program. *Mellow* consists of three subdivisions:

- Girls in secondary education 'set out for a day with a female engineer' in order to get a realistic view of her work (subdivision A).
- Experienced engineers coach students in higher technical education in making a smooth transition from study to work. It covers a period of six months before graduation until at least six months after graduations (subdivision B).
- Experienced engineers coach junior engineers in their career development (subdivision C).

The institutes execute subdivisions A and B themselves. VHTO executes subdivision C nationally. During the first few years, in addition to the mentoring contacts, a set of tools consisting of execution protocols, a guidebook/manual for mentor training and a mentor database was developed and tested [8]. Attention was paid to the ways in which this project could be embedded in the regular education practice of higher (technical) education. Links were made between intake management (information supply) and alumni policy.

During the project period (the first three years) the execution of *Mellow* went exceptionally well. Mentees, mentors and institutes were very enthusiastic and all the tools were well received. The moment that the subsidy was no longer available, the execution of *Mellow A* and *Mellow B* collapsed completely. Only *Mellow C* is still operational. This part is still organized by VHTO. Members of VHTO's network of women engineers act as mentors and mentees.

No matter how good the institute staff thinks the mentor program is (and this is a substantially larger group than only the EO coordinators), apparently it takes too much effort to organize these contacts between mentee and mentor. The *Mellow* project requires that the institutes are well organized, from the level of intake management to the existence of an alumni policy or even their relationship with the business sector. In addition, *Mellow* is organized explicitly for girls, which is at odds with present day thinking in the Netherlands. Without the extra commitment of people that are explicitly involved in the effort made on behalf of girls, this cannot be organized. The immediate benefit for the institute or the faculty concerned is too small, even though the importance of the mentor program for the individual student is recognized.

#### *Viking*

*Viking* is a project in which female engineers act as guest lecturers in higher technical education, taking part in the delivery of the technical curriculum. The objectives of the *Viking* project are:

- an increase in the number of female teachers in higher technical education;
- the guest lecturers function as role models for both female and male students;
- to foster cooperation and knowledge transfer between higher technical education and the business sector;
- to stimulate female engineers to consider a possible career in higher technical education.

A pool of female guest lecturers was established. At the moment, there are about 60 female engineers in the pool. The recruitment and selection of guest lecturers takes place in cooperation with networks and associations in which female engineers are represented and companies that are already in contact with higher technical education and VHTO. VHTO gives the guest lecturers a short, thorough didactical training that links up with the curricula concerned and the wishes of the

guest lecturer. Institutes for higher education can submit a request to VHTO for a female guest lecturer for a certain subject. VHTO checks the pool to ascertain whether a suitable person is available. The institute appoints a contact person, who will confer with the guest lecturer about the content of the lesson(s). Up till now about 35 guest lectures have taken place (1998–2001).

Viking started as a national project, coordinated by VHTO. Throughout the duration of the project, activities are undertaken so that the agreements about guest speakers lead to more structured regional co-operation between higher technical education and the businesses in the region. After completion of the project, the contacts established, the introductions made and the focal points have been passed on to the institutes. It is our hope that they will continue with their Viking activities.

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