

How to attract female students and how to make them successful in our engineering programs?

“The are not dumb, they are different”

Sheila Tobias (1990)

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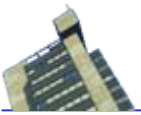


University of Twente: small research university

Mechanical Engineering: biggest engin. program

- **bachelor of science: project-led education**
 - **40% project work, 20% project-related theory and training and 40% 'traditional teaching'.**
 - **enrollment: 130 freshmen a year , < 5% females**
- **master of science: in English,**
 - **'traditional teaching methods'**
 - **competence tracks: research, design, managem.**
 - **enrollment 75 students a year**
- **PhD: 50 students, duration 4 years**





Since 1998 students at secondary school at age 14/15 have to choose a profile: a focus area.

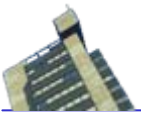
The profiles are science and humanities/social sc.

Since 1998 the students who have a science profile and are admissible to engineering studies have dropped ~10%, the fraction female students who are admissible have dropped dramatically.

Our female/total ratio dropped from 12% to 3%.

Apart from the profile there is no other entrance selection.





We have project-led education, student and staff mentoring, intensive monitoring, a student-friendly atmosphere, ‘excellent quality assurance and control systems’, wireless notebooks, but no female students....

Female participation in science and engineering is in The Netherlands extremely low...





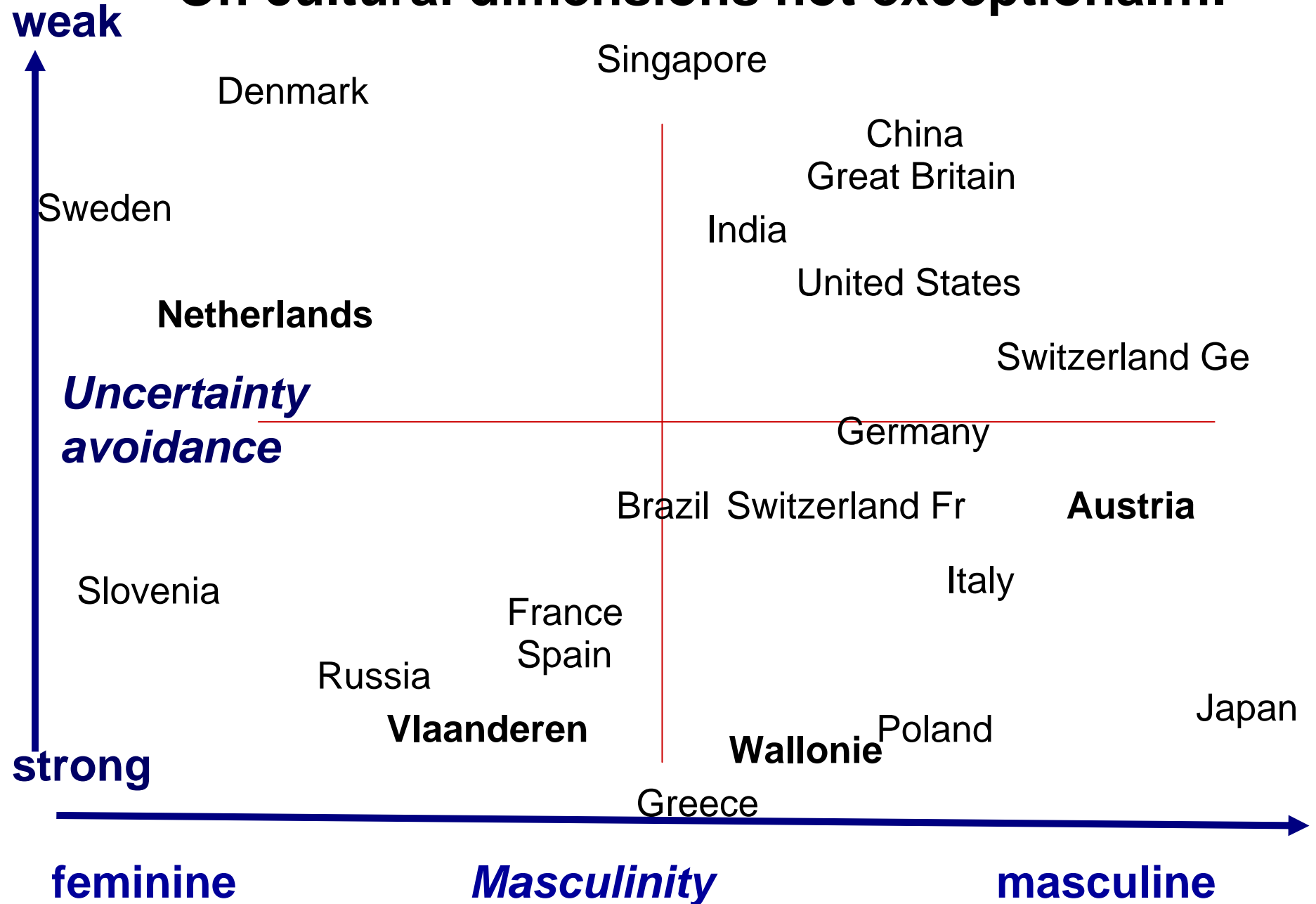
Number of graduates with sc and eng

Faculty of Engineering Technology

per 100.000 persons in the employment population in the age group 25-34 in 2003 per country (OECD, 2005).

Country	Male	Female	Total	m/f-ratio
Netherlands	1150	300	750	3.8
Austria	850	300	600	2.9
Finland	2850	1350	2200	2.1
Germany	1100	500	850	2.1
Denmark	1300	650	1000	1.9
Belgium	950	500	750	1.9
Sweden	1800	1000	1450	1.7
France /UK	2200	1500	1900	1.5
Ireland	2000	1500	1750	1.3
Spain	1200	900	1100	1.3
Italy	1000	800	950	1.3

On cultural dimensions not exceptional....





- **the few female students we have, perform better...**
- **female students with the 'wrong' profile at high school, have made the switch to industrial design engineering successfully....**
- **female students at university still lack self-confidence ...**
- **female students take specific roles in group work...**





1. since the new high school structure (1998) the enrolment ratio has decreased substantially, **but the Netherlands held already an extreme position in this respect**
 2. some female talents for science are filtered in the humanities profile
 3. female academics are increasingly unsatisfied with their careers. This is assumed to be related to making less demanding choices ..
- give female students a better and/or a second chance, because...





→ A second chance for female students

- our male students are educated in isolation of the 'normal' society;
- engineering and technology will be perceived as 'fremdkörper' (at the sideline of the society);
- mixed teams are more productive;
- the industry needs more human power;
- female students need a demanding challenge.





- 1. Why do female students abandon engineering studies? And why do they drop-out?**
- 2. Our project:**
 - additional facilities for female students who are qualified**
 - a new first year program Engineering Design & Society for talented students with the wrong profile....**





Why do female students abandon science and engineering studies?

- no role-models → **a breakthrough needs**
- perception of entering a narrow field with no way out (the inflexible image of the sector)
- **perception of a nerdish study for males**
- **perception that it is only for gifted children and this perception sustains in the university:**
***Imperial College* : first year females with 15% higher scores estimate their performance below average and female drop-out rate is 4 times higher**



Why do female students abandon science...

- In science students cannot understand where they are heading for until they get there; (uncertainty)
- So much is based on what you learned the day before, you can not permit to weaken one single day; (stress and pressure)
- There is no sense of community in science classes, the *why* questions are neglected and it is highly competitive; (no intrinsic motivation)
- Science is for in-group persons, who are born this way and not made; (perception of being an outsider)
- Science students in class copy what the teacher is writing on the board, not discussing it; (is that supposed to be a challenge?)

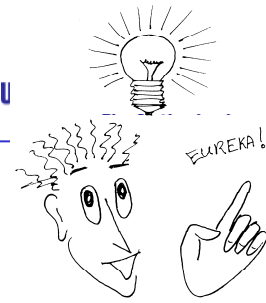


Why do female students abandon science...

- **I do not feel I can ever contribute something useful to the body of knowledge of science; (it is a mountain to be climbed);**
- **Teachers are transmitting the body of knowledge rather than introducing it; it is one way traffic; (you are not addressed as a person!)**
- **Science is not for pleasure of general utility but for a professional apprenticeship; (it is all too serious..)**
- **Many of the students who fail have the brains but a different learning style, motivation, expectations, discipline..(they are there but we ignore them!)**
- **And the females are most outspoken and insecure**



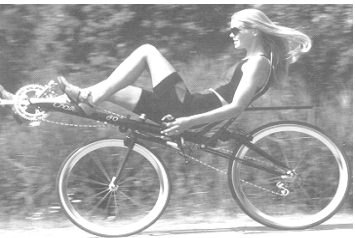
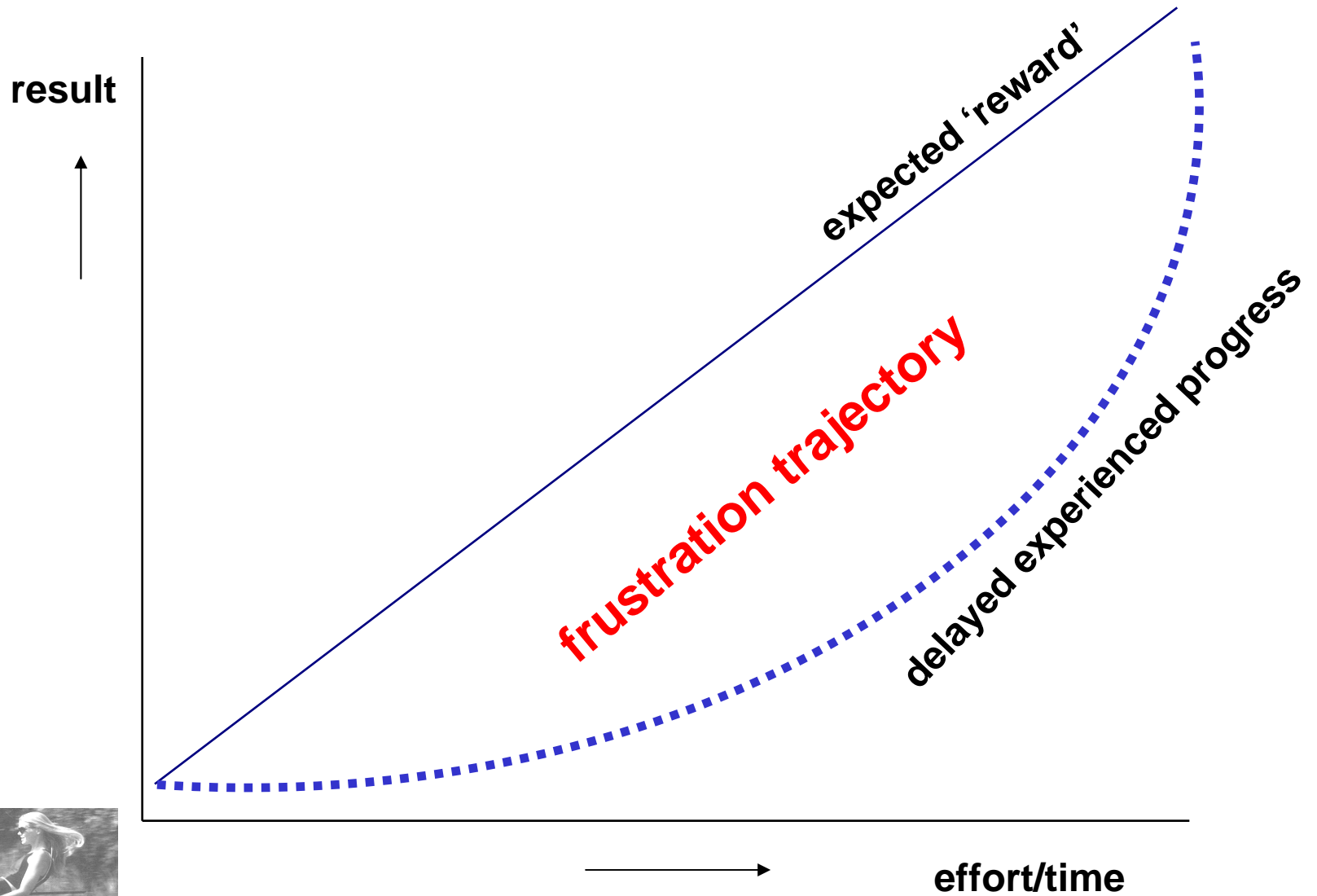
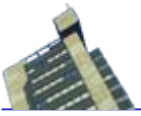
Our hypothesis



How to cope with lack of self-confidence in engineering education?

Our hypothesis: abstractness is more frightening for female students...

- many students have difficulty with the abstractness of science and engineering
- female students *being less self-confident* (more uncertainty avoiding) feel frustrated as abstractness implies delayed rewarding.





lack of self-confidence

- ❑ pre-selection on advice of secondary school counselor (personal invitation)
- ❑ pre-entry summer course and assessment:
 - give them a lead;
 - selection with advice and consequences: you are capable: **if not successful we repay your fellowship allowances....**
- ❑ adjusted didactics: starting project is more structured, more intensive guidance and more detailed feed back (and summative: this is OK)...

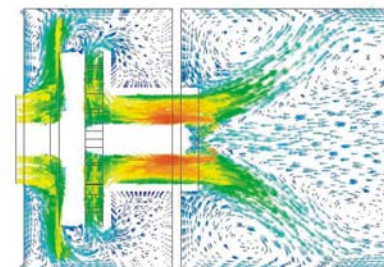


A separated first year ‘Engineering Design & Society’, using what they learned (and what they missed at secondary school combined with Eng.Design content) ...

Thereafter gradually intertwine with the regular programs in:

- Mechanical engineering**
- Civil Engineering**

→ regular bachelor of science degree





at last

“They are not dumb...” → but they do believe they are not capable to do and to ENJOY science and engineering

→we should over-compensate in a natural way (realistic experiences, social embedment).

→discussing the female issue has made us more aware of the situation at large: engineering is becoming more and more isolated with respect to society and interest of teens



Thank you for your attention!!



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