KATHOLIEKE UNIVERSITEIT
LEUVEN

Women and Engineering Studies: *a Challenging Combination*

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Content

1) Characterisation of the incoming female and male students in bachelor of science in engineering

2) Possible reasons for failure of the female students in the first year

3) What happens after the bachelor?

4) Conclusions

Characterisation of incoming students

Bachelor of Science in Engineering at KULeuven, Belgium: each year around 450 new students (only 14% female)

Are there differences between the male and the female incoming students?

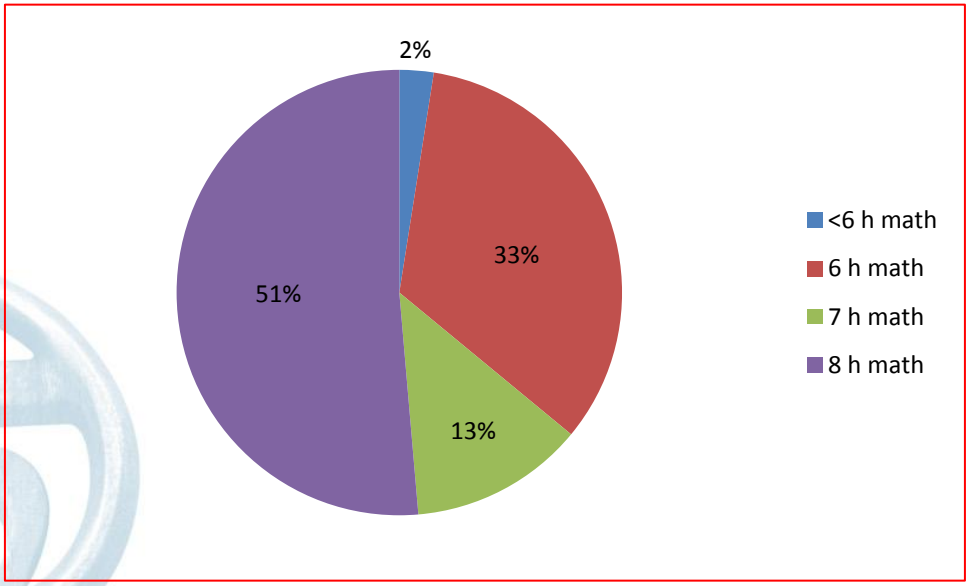
- differences in background/motivation/... ?
- differences in study behaviour ?
- differences in results on exams ?

Characterisation of incoming students

- Characterisation of the students (data gathered in 2 academic years): :
  - Written questionnaires:
    - Level of prior mathematical education
    - Overall score in high school
    - Mean reasons to choose bachelor of science in engineering
    - Their self-esteem
    - Motivation Profile
  - Time measurement study
  - Link with scores on exams?

Characterisation of incoming students

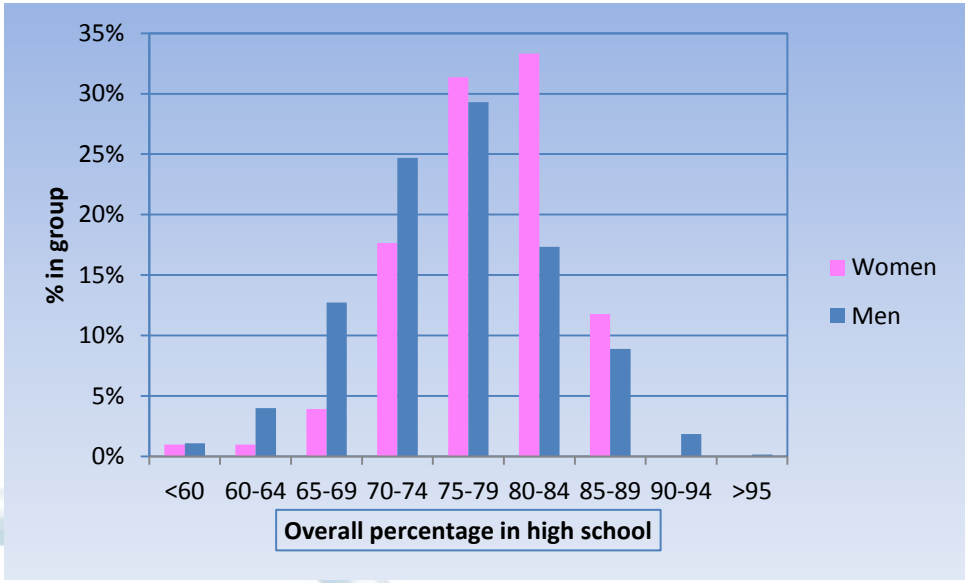
- ✓ ~90% general secondary school: Science-Mathematics or Latin/Greek – Mathematics
- ✓Hours mathematics/week: <6, 6, 7 or 8
- ✓Overall good grades: average >75%



Distribution similar men/women

Characterisation of incoming students

High school results



Characterisation of incoming students

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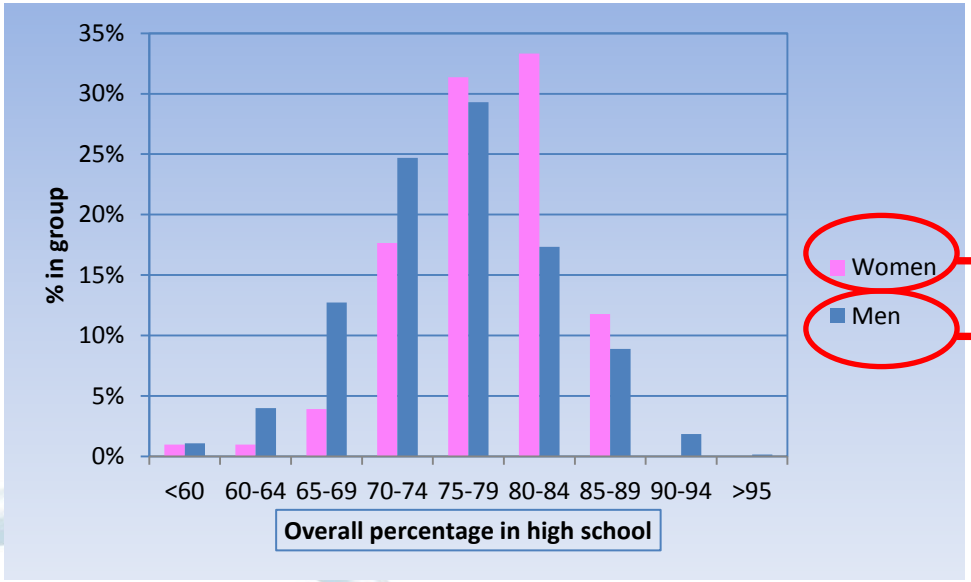


Average = 78%
σ = 6%

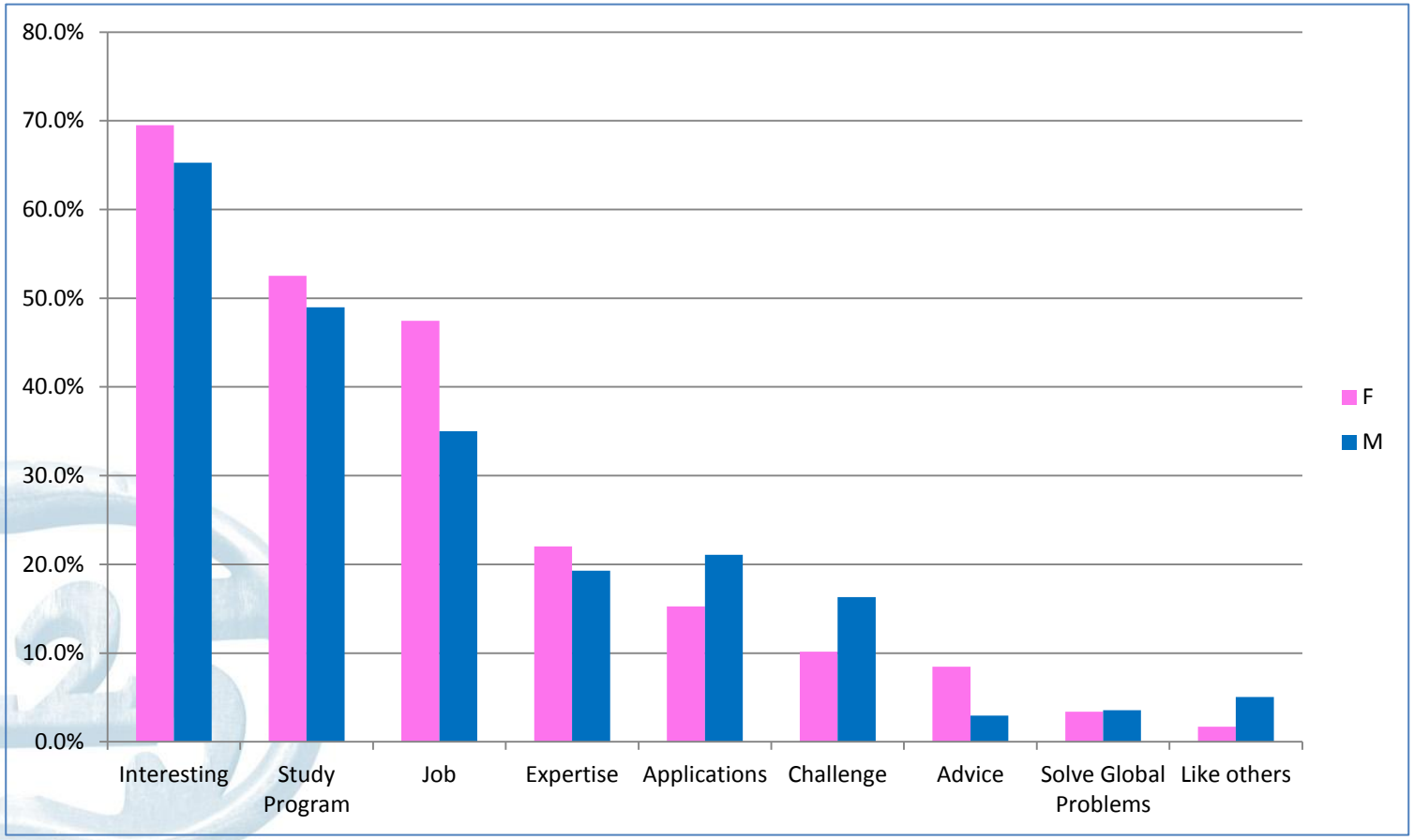
Average = 75%
σ = 7%

Women: significantly (p<0.001) higher scores in high school !

Characterisation of incoming students

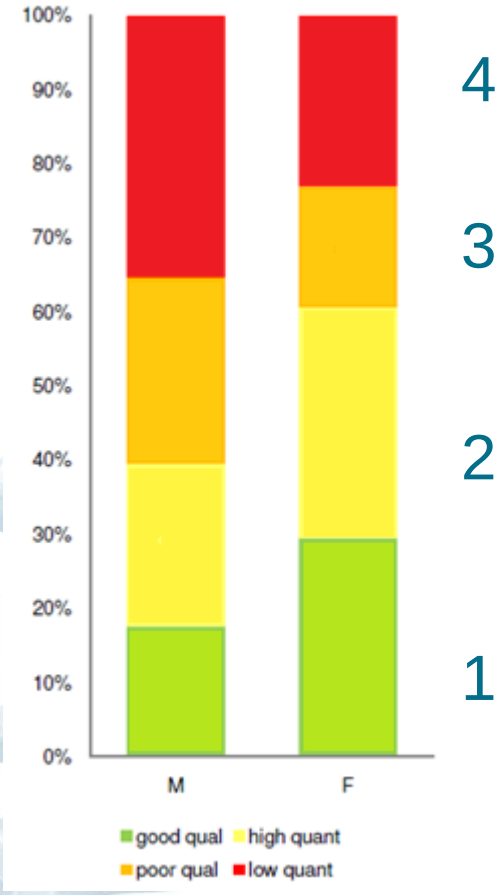
"Why did you choose this study program?"

% of students



Characterisation of incoming students

Motivation profile could predict scores (study done on other groups of students):



4

3

2

1

The quality of motivation matters!

	Aut. mot	Contr. mot
1. Good quality	High	Low
2. High quantity	High	High
3. Poor quality	Low	High
4. Low quantity	Low	Low

Vansteenkiste *et al.* 2009

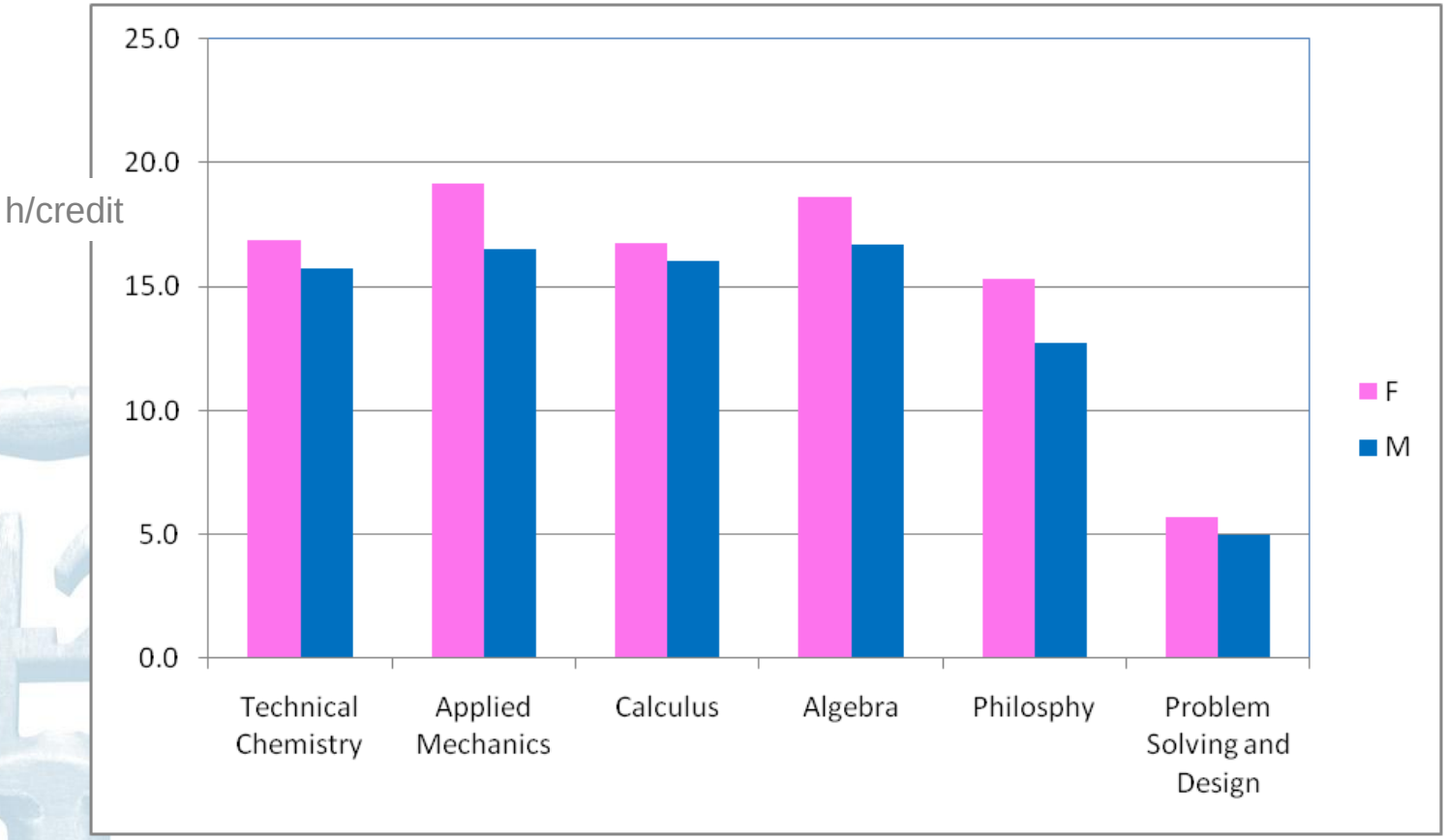
Expected scores on exams: 1 > 2 > 3 > 4

M: 2.9 (σ = 1.1)

F: 2.5 (σ = 1.0) with $p < 0.01$

Characterisation of incoming students

Time measurement: hours study/credit for the different courses of the first semester



Study results

Previous observations: the female students...

- had significantly better results in high school
- have a significantly better quality of study motivation
- spend more time in studying their courses

THEREFORE

Women should score (significantly) better at their first year

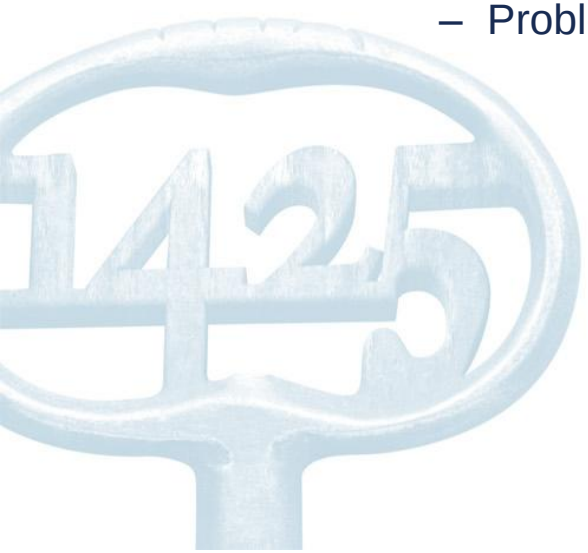
→as is the case for almost all students of other courses

Study results

Results in june

- Bachelor of Science in engineering
  - 3 semesters in common
    - Basic general courses:
      - Calculus, Algebra, Physics and Philosophy
    - Specific engineering courses:
      - Applied Mechanics, Technical Chemistry, Material Science, Informatics, Thermodynamics and Electrical Circuits
    - Course-integrated group work:
      - Problem solving and design (1st en 2nd)

Women score significantly better



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Women score significantly better

Men score (slightly) better or equal scores

- One exception: Material Science: women score better!

But average of all exams: men = women (50% passes)!

Study results

Conclusion: women do not score significantly better

Why?

Reasons for failure/success?

Results: women do not score significantly better

Why?

In contrast with the male students, the female students try more to make all exams in one examination period

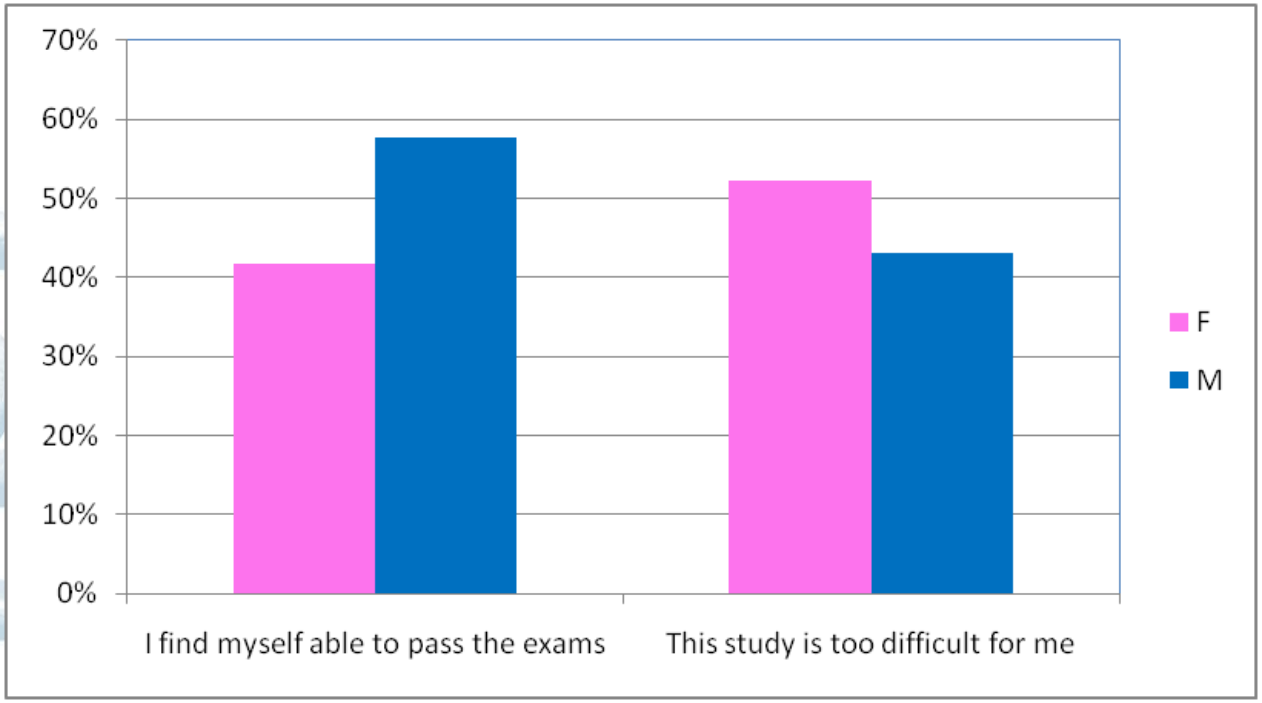
or in other words, relative more male students skip some exams and focus on the other exams, resulting in better average male scores on the exams

Reasons for failure/success?

Results: women do not score significantly better

Why?

Some female students lack self-confidence...



Reasons for failure/success?

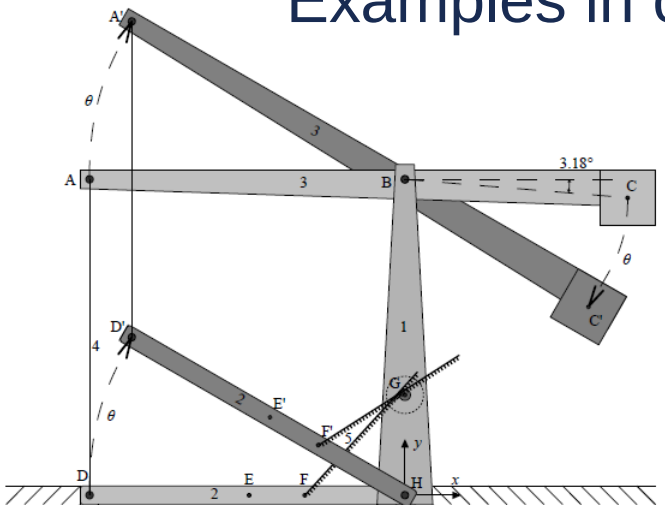
Results: women do not score significantly better

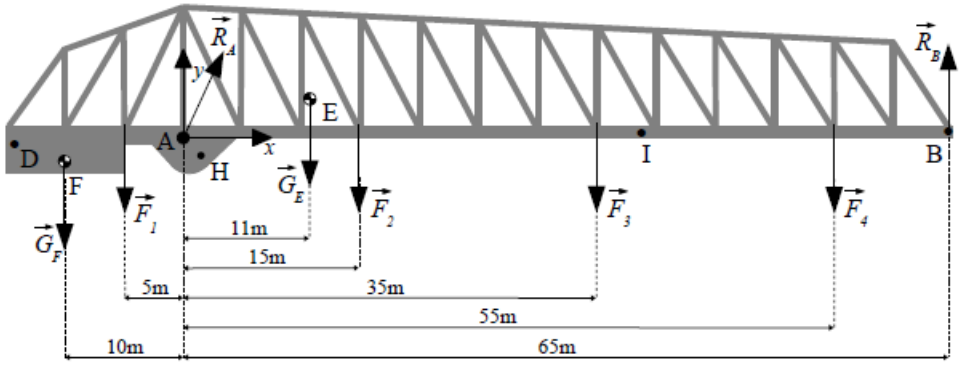
Why?

Content of some courses is more appealing for male students...

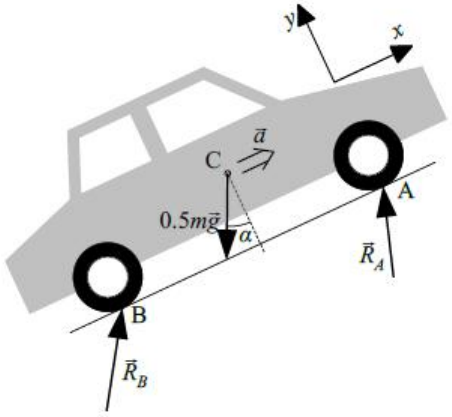
Reasons for failure/success?

Examples in course applied mechanics:

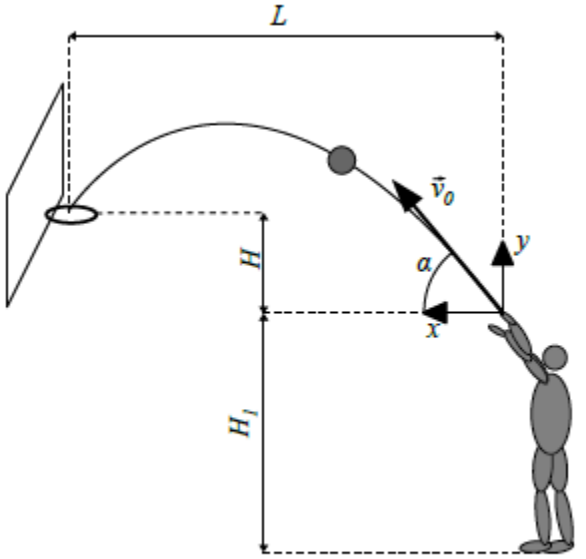




Figuur A.



Figuur A.14: Het assenstelsel en het vrijlichaamdiagram met de krachten die in een algemene situatie inwerken op de auto



Figuur 7.4: Een basketbalspeler neemt een vrijworp

Reasons for failure/success?

Examples in courses thermodynamics and technical chemistry:

Propulsion, Combustion engines, ...

Propulsie

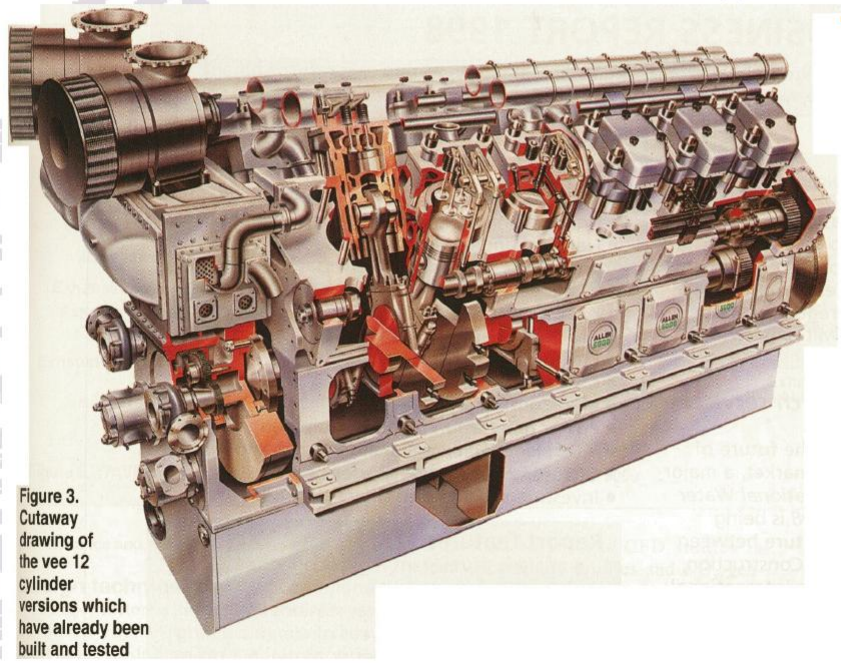
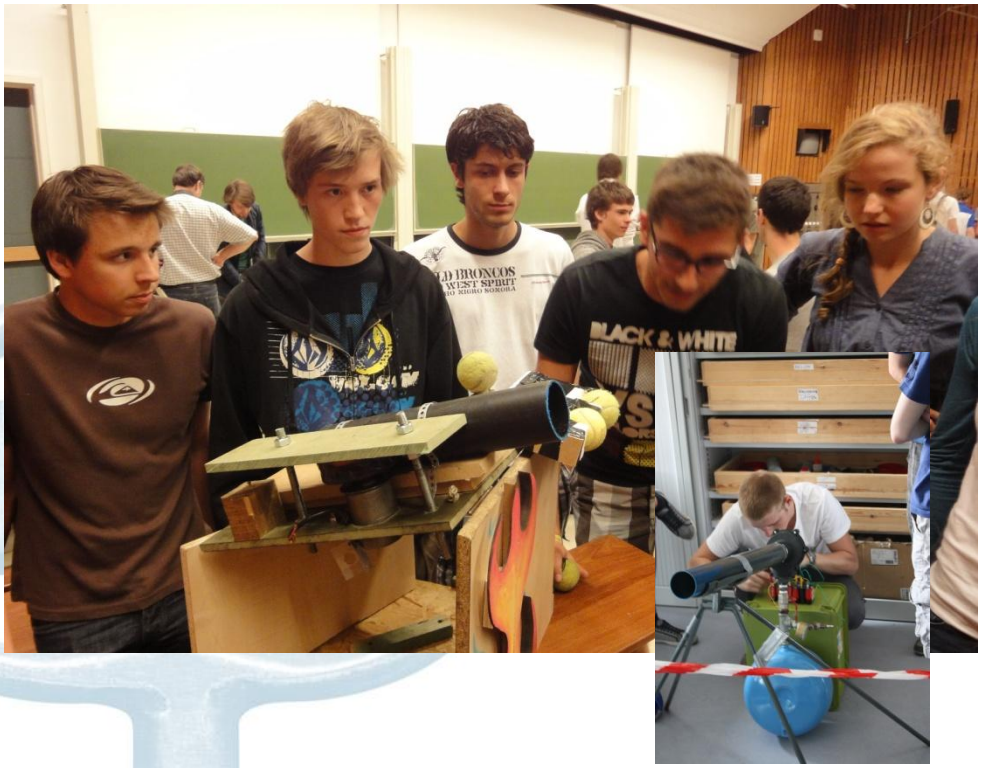


Figure 3. Cutaway drawing of the vee 12 cylinder versions which have already been built and tested

Reasons for failure/success?

Examples in course Problem Solving and Design:

Tennisball machine



Waterrocket

After the bachelor...

- Engineering Studies at KULeuven, Belgium:
  3 years Bachelor + 2 years Master

- Bachelor of Science in engineering
  - 3 semesters in common (general mathematical courses and specific technical engineering courses)
  - After 3 semesters: choose a major/minor combination for the next 3 semesters
    - Eg.
      - Ma Electronics – Mi Computer Sciences
      - Ma Mining en Geotechnical Engineering – Mi Material Sciences
      - Ma Mechanical Engineering – Mi Technology of living systems

After the bachelor...

- 3 years Bachelor + 2 years Master

- Master of Science in engineering
  - Eg.
    - *Master of Science in Biomedical Engineering*
    - Master of Science in Mechanical Engineering
    - Master of Science in Civil Engineering
    - Master of Engineering: Computer Science
    - Master in Nanoscience and nanotechnology
    - ...

14% female students in bachelor of science in engineering

>30% of the master students in biomedical engineering are female !

Conclusions

- ✓ Incoming students bachelor of science in engineering: characteristics of female students (only 14%):

  Are more motivated, had higher grades in high school, spend more time to study their courses

  Results on general courses are indeed better !

  Results on some typical engineering courses are similar or even worse

- ✓ Reasons?

  Male students focus more on some courses and skip exams

  Lack of self-confidence

  Exercises / Applications given in courses: more male-orientated?

- ✓ However…

  once finding a more appealing technological domain the female students (>30%!) are very motivated to make the choice for Master in Biomedical Engineering!