IT'S MY CHOICE!
WOMEN IN SCIENCE AND TECHNOLOGY

ERASMUS STAFF WEEK IN BREMEN, MAY 7TH 2019

Universität Bremen

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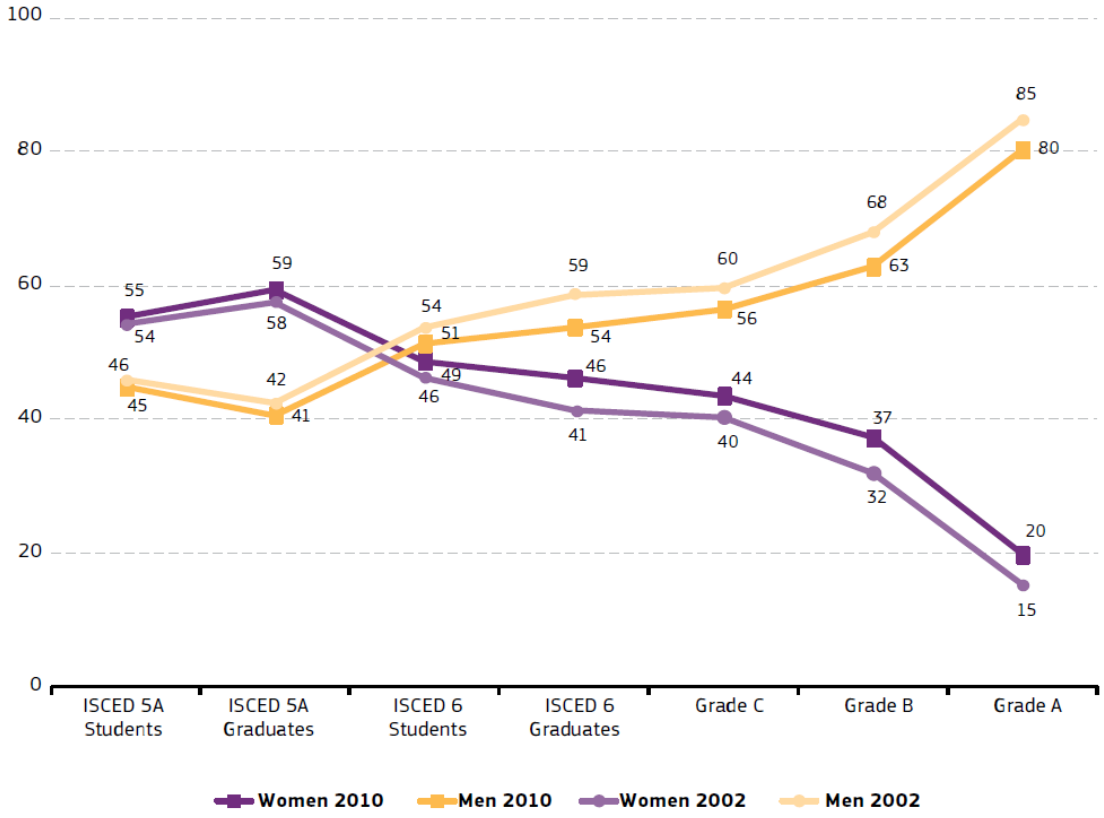
Women and men in academia

Proportions of men and women in a typical academic career, students and academic staff, EU-27, 2002–2010



Source: She Figures 2013 European Commission, p.88

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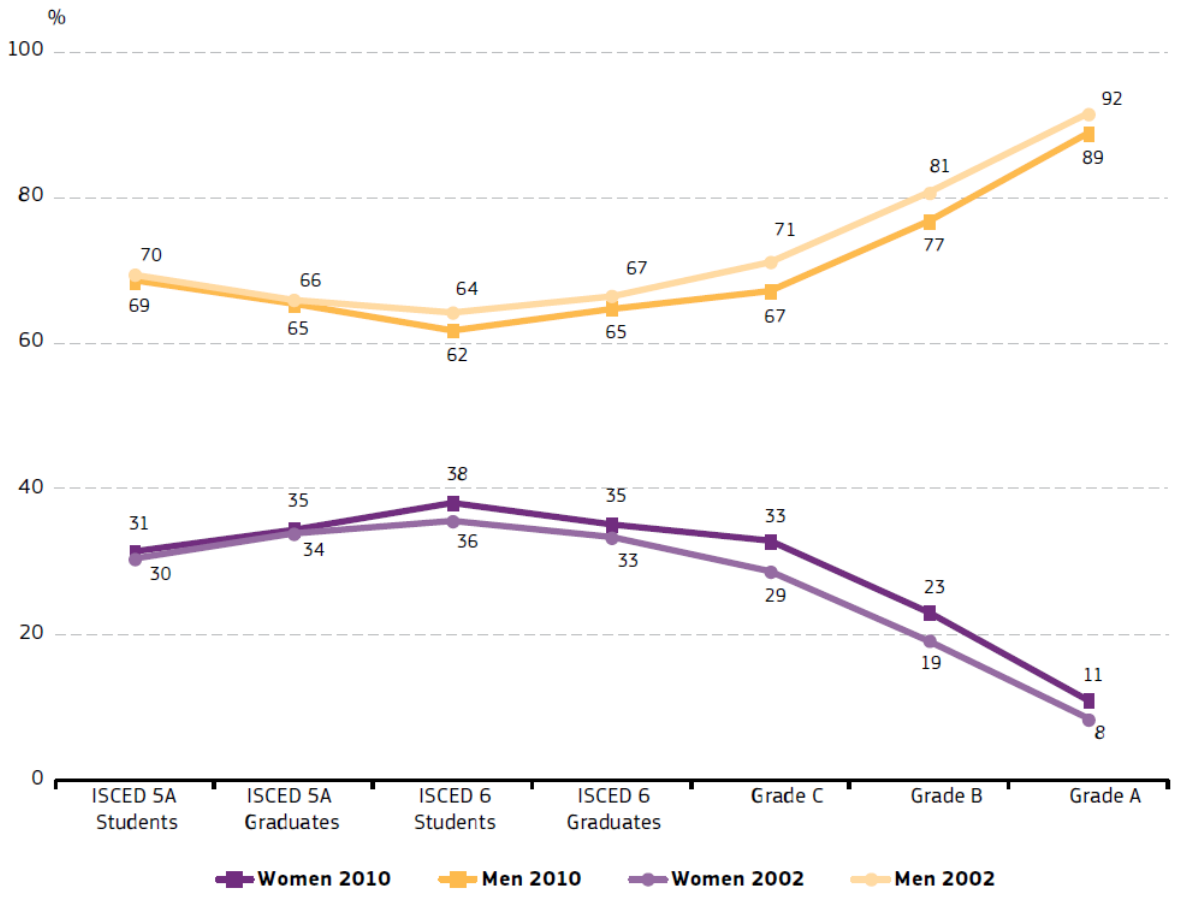
The “leaky pipeline”
Women and men in science and engineering



Source: She Figures 2013 European Commission p 89

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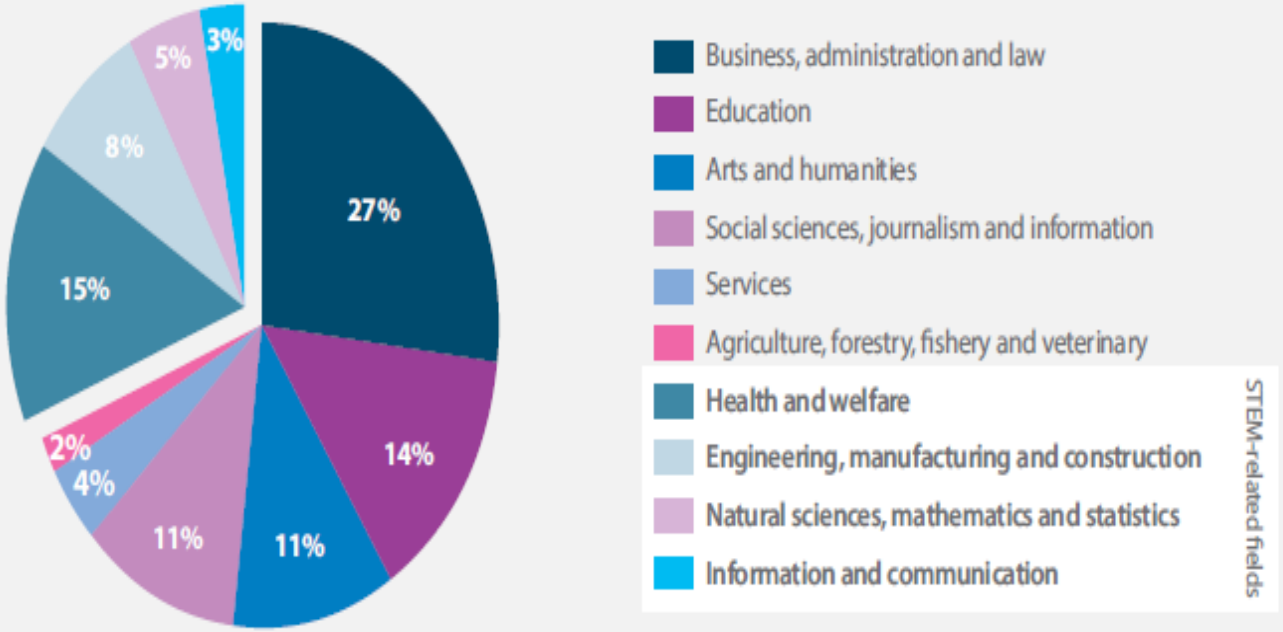
Interest in STEM studies

Figure 5: Distribution of female students enrolled in higher education, by field of study, world average



Only around 30% of all female students select STEM-related fields in higher education.
110 countries and dependent territories.

Data source: UIS 2014-2016[25]

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IRIS

WHAT ARE THE REASONS FOR THE CHOICE, THE REMAINING OR LEAVING OF A STEM STUDY PROGRAMME?

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European Project IRIS

EU 7th Framework Programme – Science in Society Grant Agreement No.: 230043

Interests & Recruitment In Science

Factors influencing recruitment, retention and gender equity in science, technology and mathematics higher education (STEM)

- Coordinated by the University of Oslo
- Partners in 5 European countries: Norway, UK, Italy, Denmark, Slovenia
- Associated partners: **Germany, Austria – coordinated by Uni Bremen**
- **http://iris.p-7.org/about-iris/**

The need of a greater STEM workforce

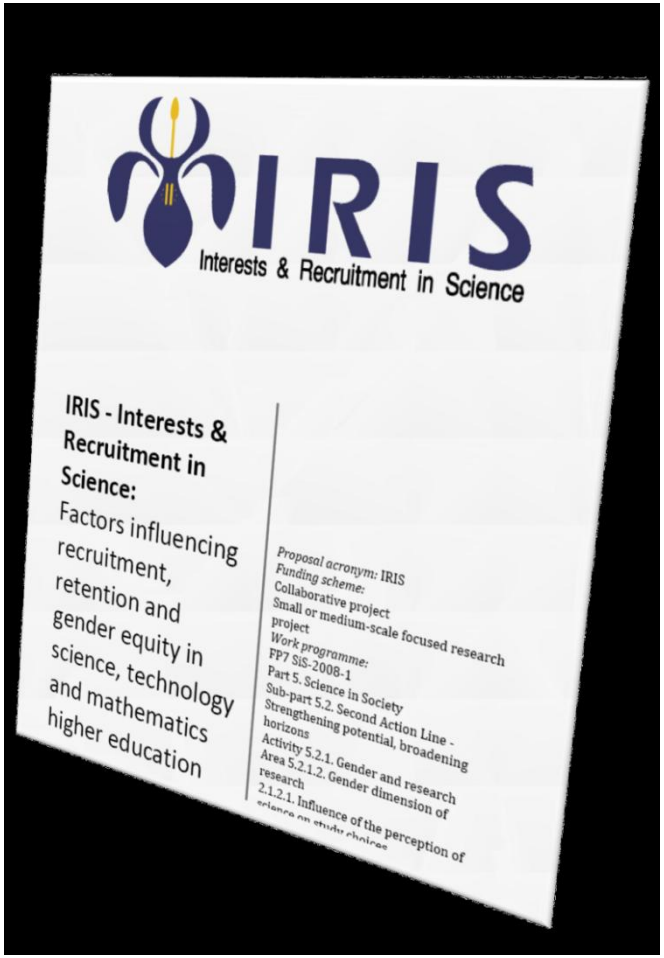
- A competent workforce within the **S**cience, **T**echnology, **E**ngineering and **M**athematics (**STEM**) disciplines is essential in order to meet some of the great challenges of the 21st century: renewable energy, communication, agricultural technology, medical treatments, transport etc. (IRIS consortium 2012)
- **STEM** is an important sector for economic growth in European countries (EU, 2010).
- Shortage of STEM-educated personnel in Europe and most Western countries → There is a need for greater participation of women in STEM (EU, 2004, 2008; OECD, 2008).

Aims of IRIS

- On what priorities, values and experiences do young people base their **educational choice**?
- What are the success factors for **recruiting** more female students to STEM?
- Why do (some) students **opt out** of STEM education?

European Project IRIS

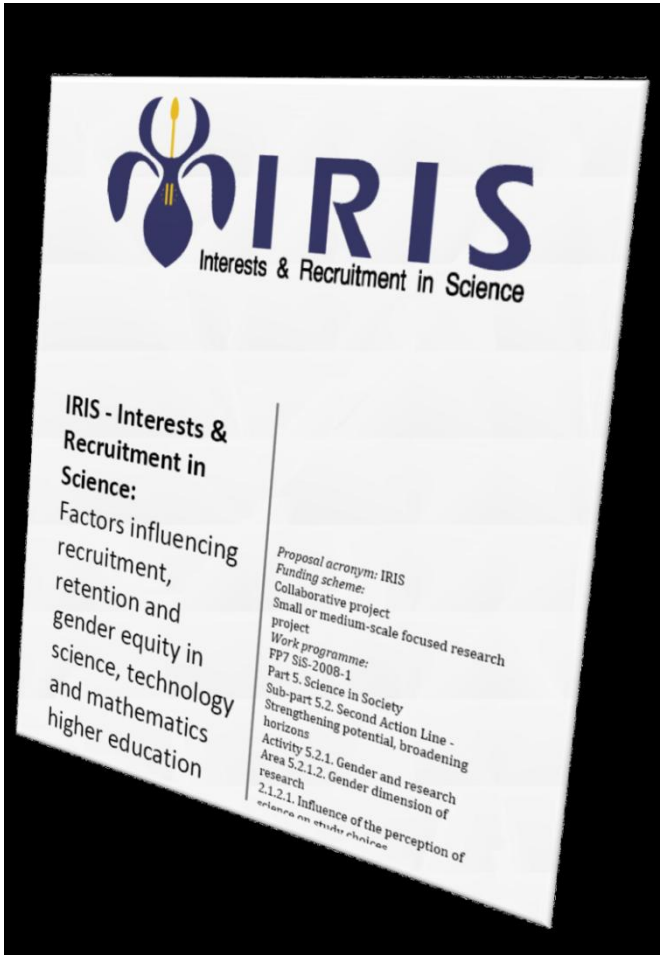
- Electronic questionnaire
- Target population: first-year students within 8 STEM disciplines defined through the ISCED Classification:
  - Biology,
  - Physics,
  - Chemistry,
  - Computer Science,
  - Engineering (mechanical, electronics, computer science)



European Project IRIS

65 items covering

- **school science experiences**,
- inspiration for **choice of education**,
- expectations for future job,
- **students' first-year experiences**, and
- attitudes to gender equity in STEM.



IRIS in Germany and Austria

- Germany: N = 2236
  - Male: 58%, female 42%
- Austria: N = 1344
  - Male: 50%, female 50%

- Questionnaire survey at the end of the 1st study year
- Qualitative interviews with female students at the beginning and at the end of the 1st study year and at the end of their study programme (N=18)

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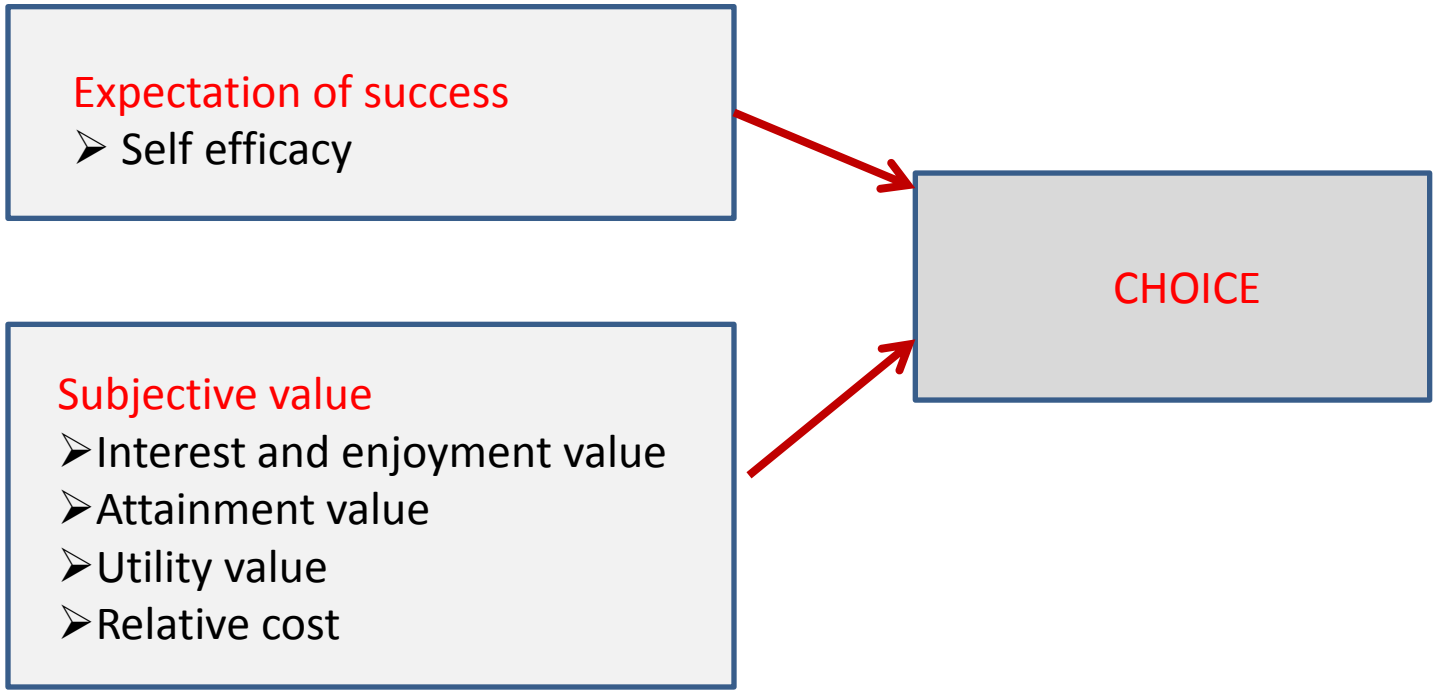
IRIS Interests & Recruitment in Science

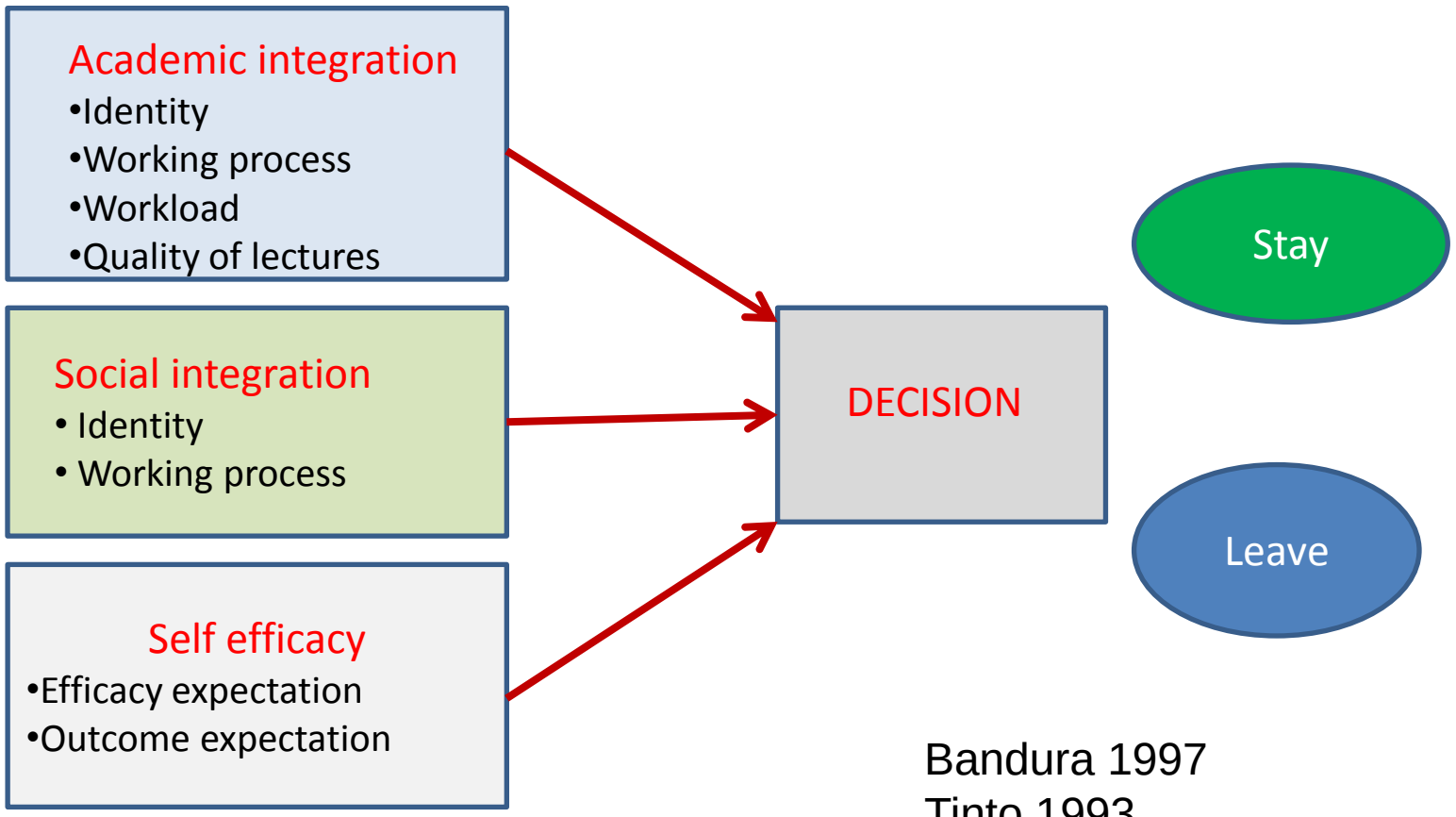
THEORETICAL FRAME

Expectancy-Value-Model



Eccles & Wigfield 2002

Self-Efficacy Theory and Model of Student Retention



Bandura 1997
Tinto 1993

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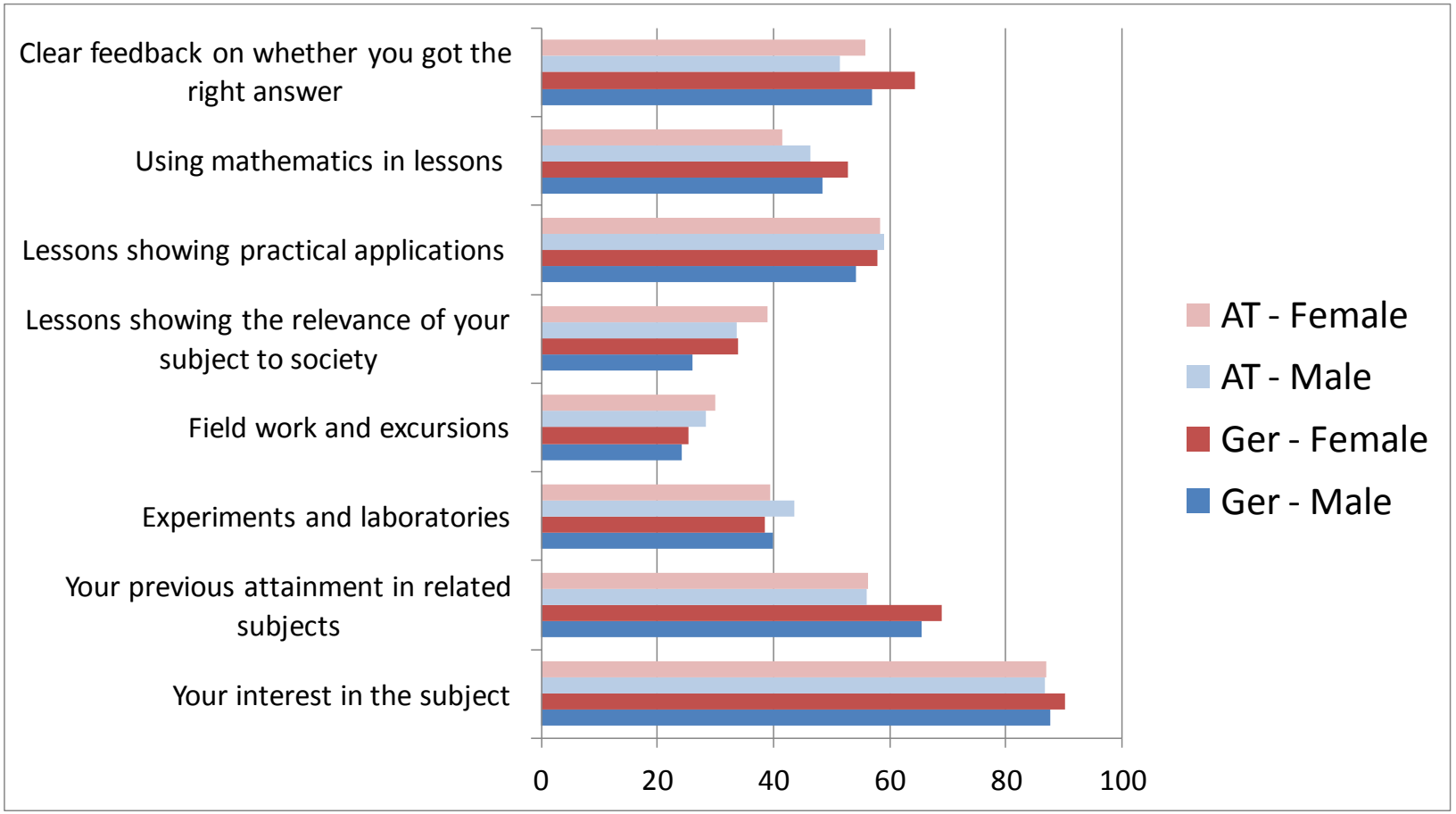
WHICH FACTORS INFLUENCE THE CHOICE OF A STEM STUDY PROGRAMME?

School experiences

How important were school experiences in choosing your course?

(% of agree and strong agree; AT = Austria; Ger = Germany)

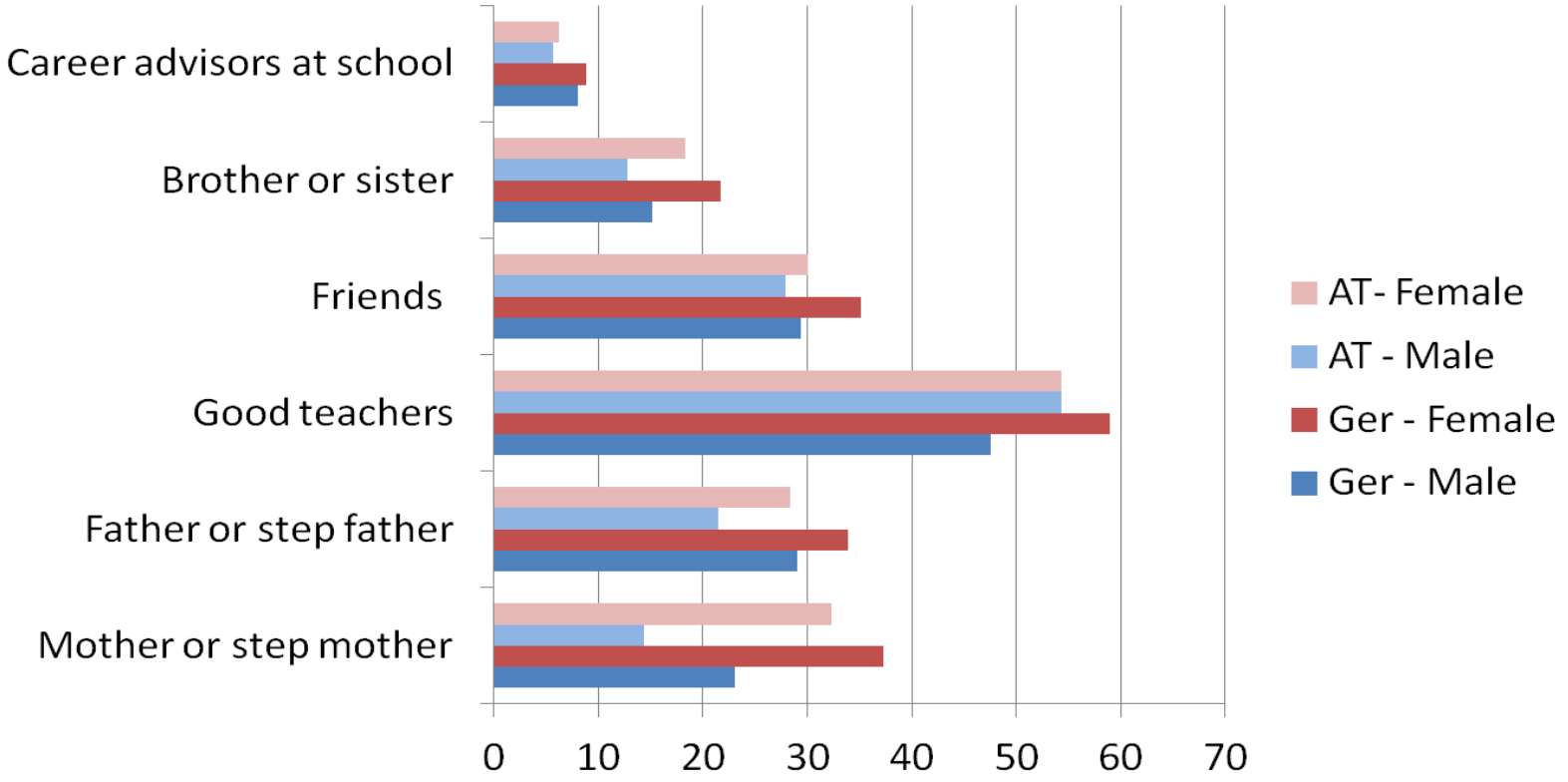


Secondary school is crucial in choosing a STEM study. → interest, previous attainment, practical applications, relevance for society.

Choice process: importance of key persons

How important were the following persons in choosing your course?

(% of agree and strong agree; AT = Austria; Ger = Germany)



Key persons are good teachers. For female students family and friends are more important than for males.

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IRIS Interests & Recruitment in Science

HOW DO THE STUDENTS EXPERIENCE THE SITUATION AFTER THE 1ST STUDY YEAR?

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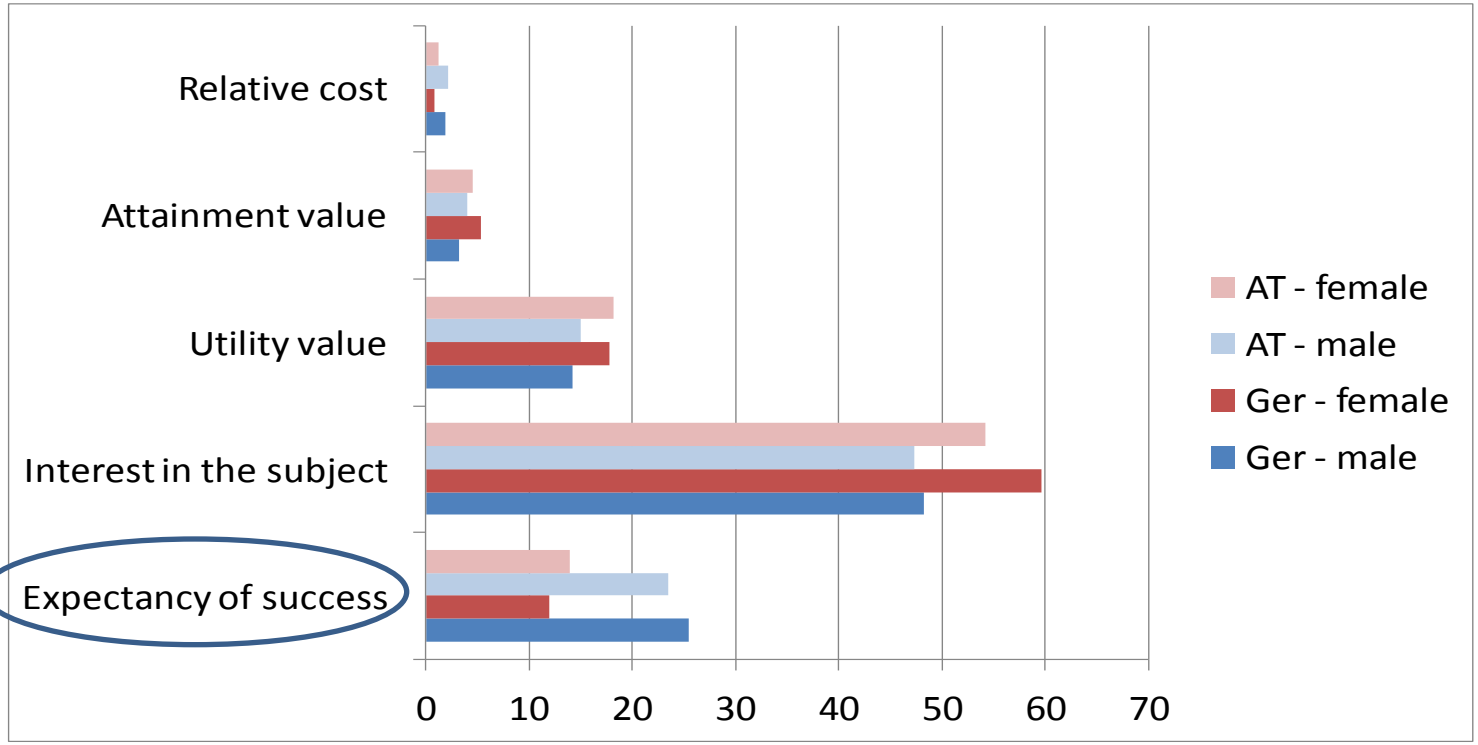
Expectancy of success

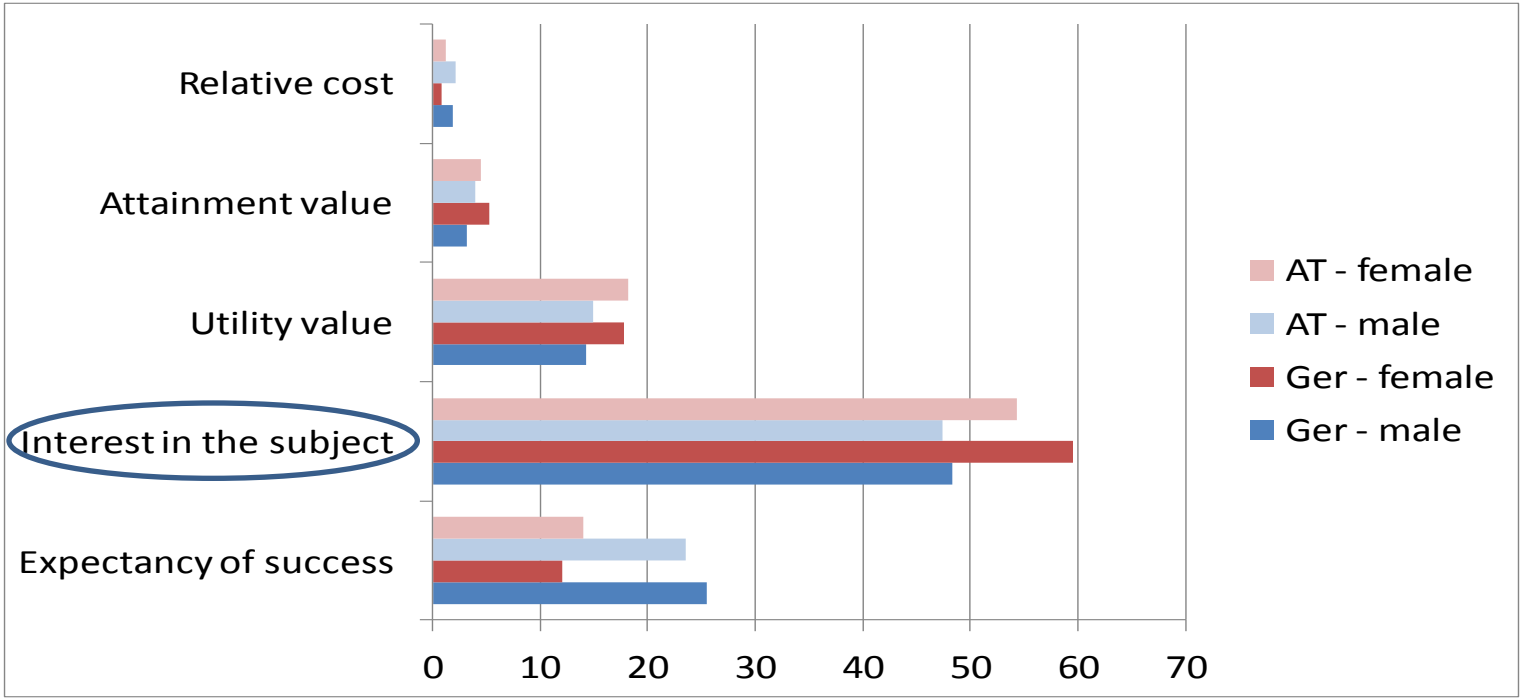
(% of agree and strong agree; AT = Austria; Ger = Germany)



Expectancy of success: I am confident that I am good enough at the subjects in this course.

Interest and enjoyment

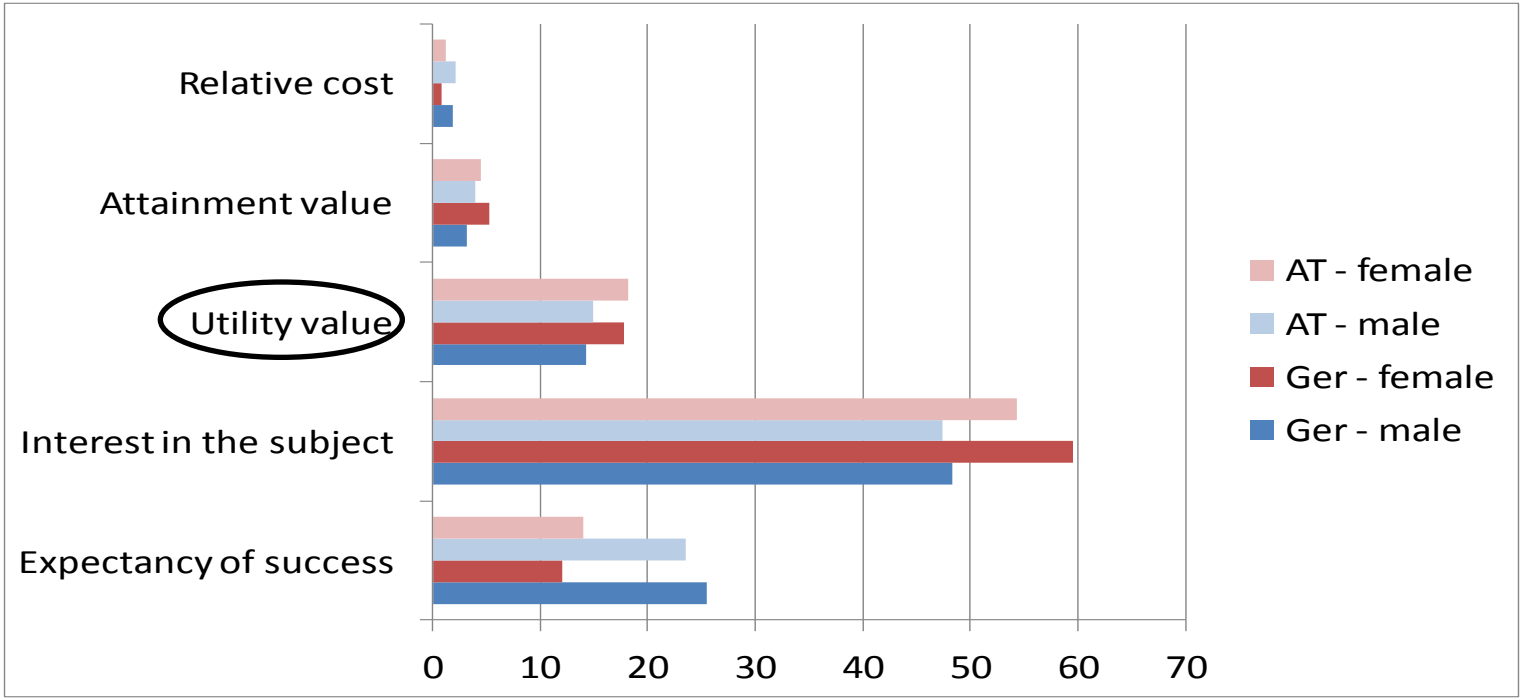
(% of agree and strong agree; AT = Austria; Ger = Germany)



Interest enjoyment value: How interesting is the content of the course?

The overall experience of being a student in this programme

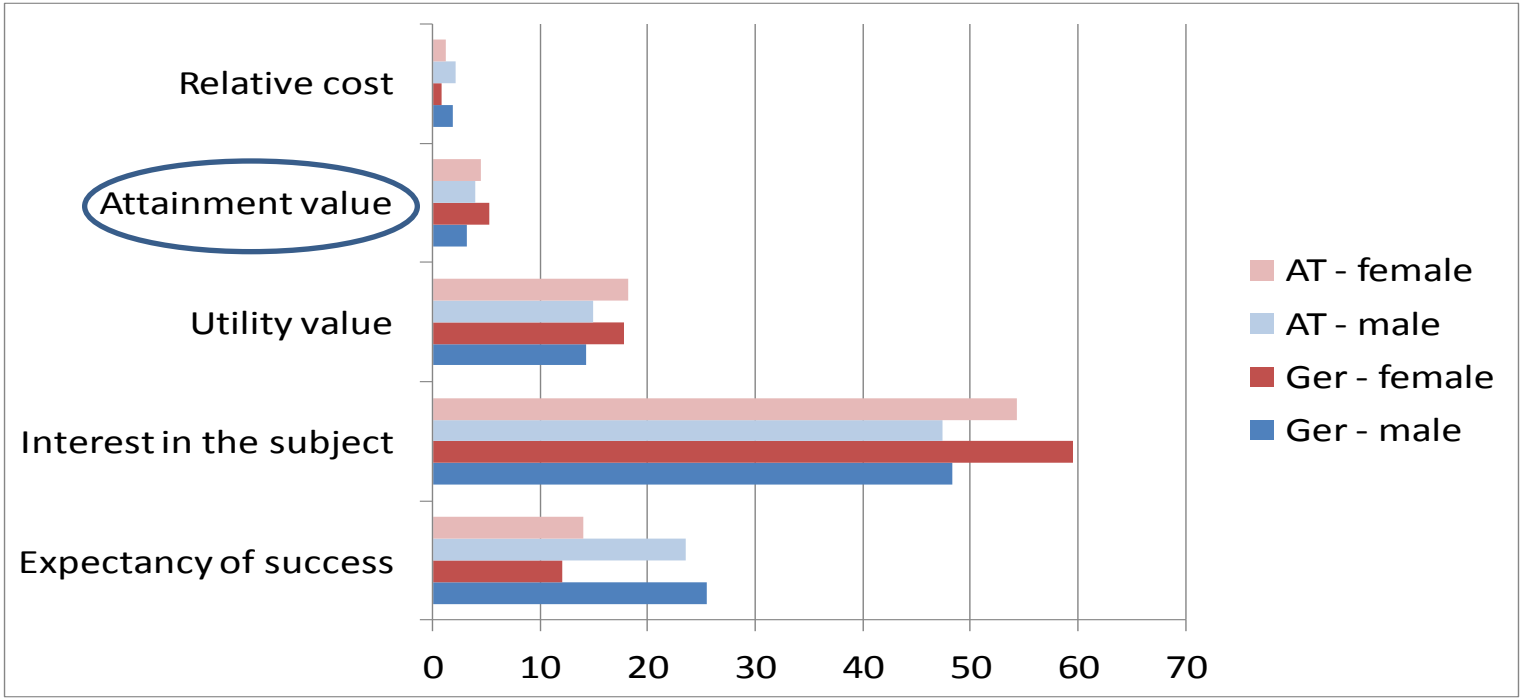
(% of agree and strong agree; AT = Austria; Ger = Germany)



Utility value: I can see the relevance for what I learn.

Attainment value

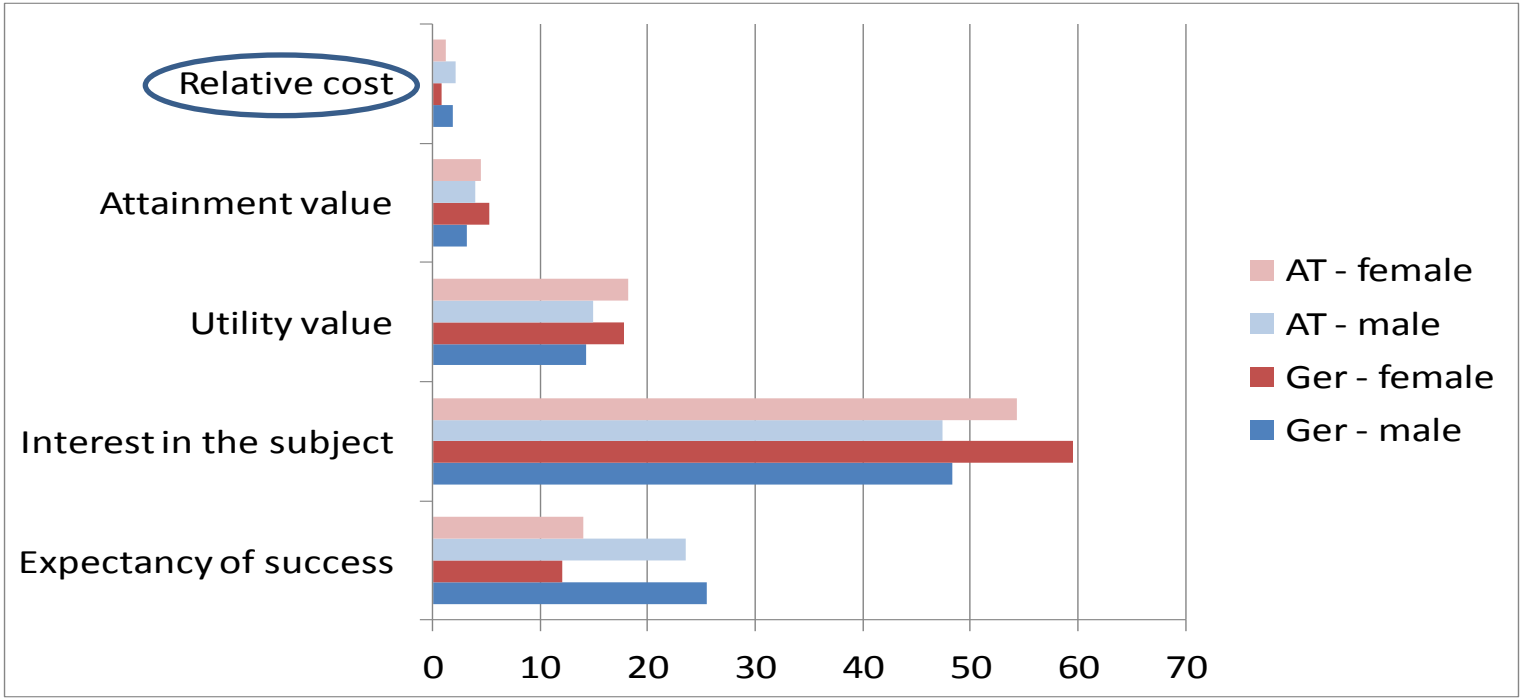
(% of agree and strong agree; AT = Austria; Ger = Germany)



Attainment value: I feel that the course fits the person that I am.

Cost

(% of agree to “Better than expected”; AT = Austria; Ger = Germany)



Relative cost: The effort you have to spend on your study.

Retention: Was the study choice the right decision?

- Most of the students are sure that they have chosen to study properly.
- Women are less sure about choosing the right study than men.

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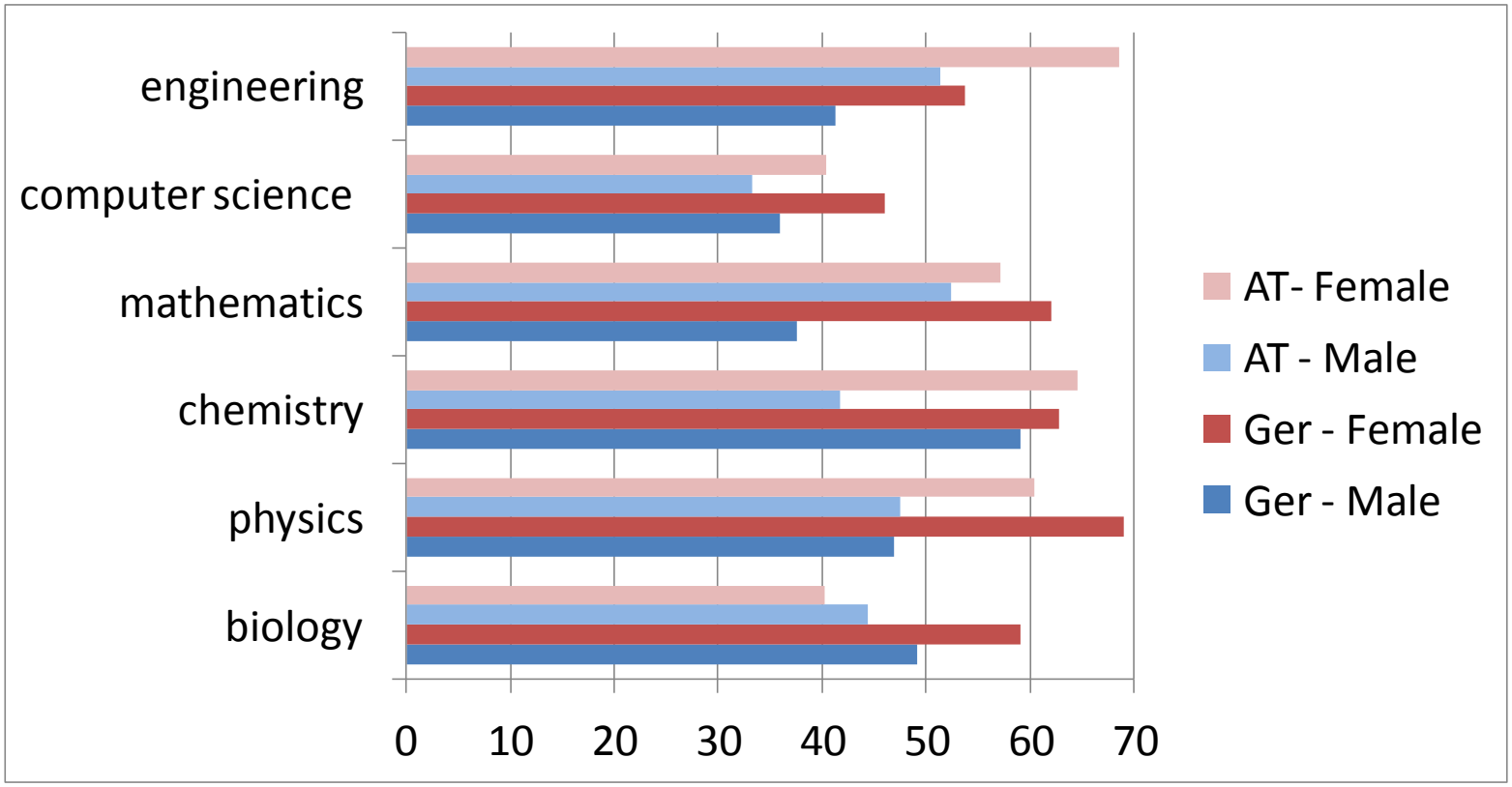
Social: "Your social relationship with your fellow students."

(% of "Better than expected" 3-point-Likert scale; AT = Austria; Ger = Germany)



"Generally a good social life." Females recognize/value that more than males.

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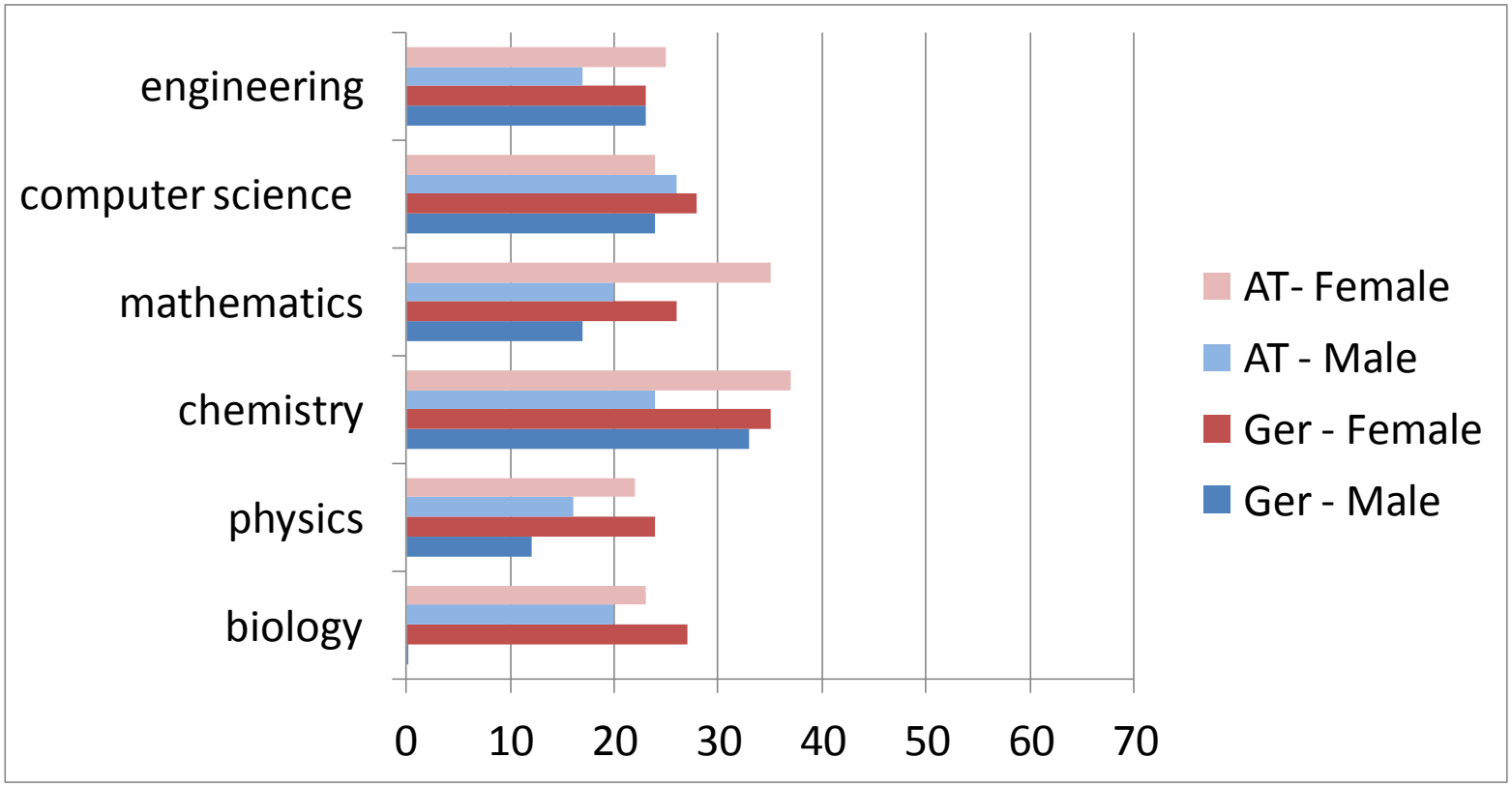
Academic: "Your integration in research groups and academia."

(% of "Better than expected" 3-point-Likert scale; AT = Austria; Ger = Germany)



"Generally sufficient." Females recognize/value the academic integration more than males.

Opt out: Are the students thinking about giving up their studies?

- 22,8% of the female students consider giving up their studies
- 14,7% of the male students consider giving up their studies.
- Statistically highly significant relationship between Gender and study dropout (p = 0.001 **).

Preventing drop out ……

Show that students are part of the social and scientific community – make them confident that they can succeed!

Preventing drop out……

Make it clear that STEM studies are hard and demanding; assure them that they will get support

Summing up

The experiences in secondary school is important in choosing a STEM study

Key persons: good teachers

Key factor: interest towards the subject

Implications for supporting first-year students and preventing drop out

- Let students understand that STEM education is **interesting and meaningful** for their future life.
- Let students understand that STEM education will be a possibility to **realize the own potential**
- Strengthen **self efficacy**; reduce the impact of perceived cost.
- Support students by their **social and academic integration.**
- Support **mentoring systems** esp. for female students

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Thank you for listening.

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References

- Bandura, A. (1997). *Self-efficacy: the exercise of control.* New York: Freeman.
- Eccles, J., Barber, B., Jozefowicz, D. (1999). Linking gender to educational, occupational, and recreational choices: Applying the Eccles et al. model of achievement-related choices. In W. Langlois & L.A. Gilbert (Eds.). *Sexism and stereotypes in modern society: the gender science of Janet Taylor Spence.* (pp. 153-192). Washington DC: American Psychological Association.
- EU, (2013): She Figures 2012 - Gender in Research and Innovation, Brussels
- Mauk, V., Elster, D. (2011). Einflussfaktoren der Wahl naturwissenschaftlicher Studiengänge. In: Didaktik der Biologie. Standortbestimmung und Perspektiven. Bayreuth: Universität Bayreuth.
- Tinto, V., (1993): Leaving college - Rethinking the causes and cures of student attrition (2nd ed.), Chicago/London: The University of Chicago Press
- Wigfield, A. & Eccles, J. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology (25),* 68-81.