

HRK

Stocktaking of Engineering Education in Germany: has there been a cultural shift?

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HRK German Rectors' Conference
Project nexus
Concepts and good practice in Higher Education

Structure

1. Stocktaking of Engineering Education in Germany
2. Initiatives and Activities to Enhance Teaching and Learning
3. Engineering Education and Projekt KIVA at TU Darmstadt
4. Conclusion

Engineering Study Programs*

Winter term	total	thereof			
		Bachelor	Master	together	Percent of total
2005/2006	2.109	553	456	1.009	48
2006/2007	2.244	818	554	1.372	61
2007/2008	2.223	1.058	691	1.749	79
2008/2009	2.454	1.325	878	2.203	90
2009/2010	2.632	1.443	1.002	2.445	93
2010/2011	2.792	1.540	1.098	2.638	95
2011/2012	2.987	1.643	1.222	2.865	96
2012/2013	3.150	1.709	1.332	3.041	97

* A study program may be associated with two or more subject groups.

Source: HRK-Higher Education Compass, 2012

Bachelor and Master Graduates in Engineering Study Programs

Winter term	Engineering Graduates	Bachelor	Master	Bachelor and Master	Percent of total
2005	37.071	1.089	2.597	3.686	10
2006	38.708	1.648	3.181	4.829	13
2007	41.803	2.582	3.861	6.443	15
2008	46.210	5.426	4.057	9.483	21
2009	50.628	11.981	4.417	16.398	32
2010	59.249	20.326	5.912	26.238	44
2011	66.904	31.272	10.079	41.351	62

Source: Federal Bureau of Statistics, HRK-calculations 2012

Students' Dropout and Attrition Rate in Engineering Study Programs*

	Drop-out		Change of subject or degree		Attrition rate		Student gain		Attrition balance
Bachelor University	48	+	8	=	56	-	9	=	47
Bachelor University of Applied Sciences	30	+	1	=	31	-	12	=	19

* Graduates of the year 2010

Source: HIS - Institute for Research on Higher Education, 2012

Students' Drop-out in Specific Engineering Study Programs and by sex*

Drop-out	total	mechanical engineering	electrical engineering	civil engineering	female	male
Bachelor University	48	53	53	51	42	49
Bachelor University of Applied Sciences	30	32	36	36	28	31

* Graduates of the year 2010

Source: HIS - Institute for Research on Higher Education, 2012

Mobility in Engineering Study Programs

Percentage of German Engineering Students with a study relevant stay abroad

	2007	2009	2011
Engineering students	16	16	17
All students	23	26	25

Source: HIS - Institute for Research on Higher Education, 2011

Employability and Career Satisfaction of Engineering Bachelors one Year after Graduation

	Unemployment (%)	Inadequate employment (%) *	Satisfaction** with career situation (%) ***
Bachelor University	1	23	71
Bachelor University of Applied Sciences	3	10	66

* Regarding University Bachelors data is only available for the group of STEM subjects

** very high satisfaction and satisfaction

*** Regarding University Bachelors data is only available for the group of STEM subjects

Source: HIS - Institute for Research on Higher Education, 2011

Findings

- 97% of engineering study programs are bachelor or master programs
- 62% of the engineering graduates complete bachelors or masters
38% complete „Diplom-Ingenieur“ degrees
- Student drop-out is high in engineering education (48% resp. 30%)
- The mobility of engineering students is low (17%)
- Most of the engineering graduates find adequate employments (77% resp. 90%)
- Young professionals are mostly satisfied with their career (71% resp. 66%)

→ Reduce drop-out rates!

→ Enhance mobility!

Engineering Specifics

- Engineering studies are known as difficult and stressful
- Prerequisites (mathematics, chemistry, physics, technical understanding) are indispensable
- Engineering studies are demanding from the beginning on
- Engineers are in demand in the labour market

Initiatives to Enhance Teaching and Learning in (Engineering) Study Programs

- Plenty and diverse initiatives by Universities
- Initiatives by employers' foundations and by federal and state governments
- E.g. „Quality in Teaching Pact“: Federal Ministry of Education and Research and Standing Conference of the Ministers of Education and Cultural Affairs of the Länder: 2 billion Euro.

Objectives of the Initiatives

- Strengthen the importance of teaching and learning
- Foster active, student-centered and outcome-oriented learning methods
- Push design and testing of innovative teaching methods
- Attract more (non-traditional) students for STEM subjects
- Decrease student drop-out

Activities and Tools to Improve Engineering Education and Reduce Drop-out

- Improve counselling for first semester students,
- Offer preparatory courses & supporting courses
- Improve support for students by tutors and mentors (first semester),
- Offer courses to train how to study (learning styles, time management),
- Install warning systems and monitoring systems to recognize threatened students,
- Develop problem-oriented and problem-based learning methods for engineers,
- Develop project-based learning methods to strengthen employability,
- Use new media and train teachers to use these in courses and for distant learning,
- Qualify staff for teaching, counselling and support,
- Recruit additional staff to improve the faculty-student ratio.

Profile of TU Darmstadt

25.000 Students

4.300 Foreign Students (included)

2.800 Graduates

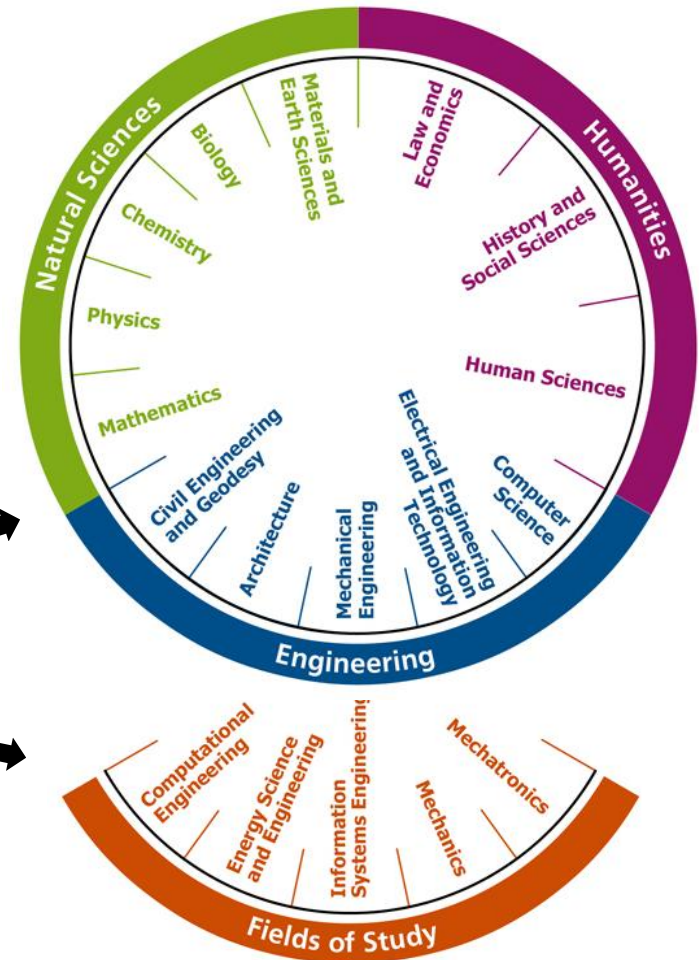
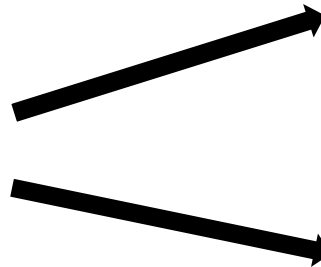
320 Doctorates awarded

286 Professors

100 Degree programs

13 Departments

4 Fields of studies



10/29/2012

TU Darmstadt, Facts and Figures I

Number of Engineering Degree Programs

Winter term	total	thereof			
		Bachelor	Master	together	% of total
2005/2006	32	11	11	22	69
2006/2007	32	16	12	28	88
2007/2008	33	16	14	30	91
2008/2009	33	18	14	32	97
2009/2010	41	19	21	40	98
2010/2011	46	19	26	45	98
2011/2012	46	19	26	45	98
2012/2013	47	19	27	46	98

TU Darmstadt, Facts and Figures II

Number of Engineering Students

Winter term	Engineering Students	Bachelor	Master	Bachelor and Master	Percent of total
2005	9.791	1.191	354	1.536	16
2006	9.209	2.003	331	2.334	25
2007	8.774	3.515	328	3.843	58
2008	10.332	5.401	564	5.965	69
2009	11.591	7.104	930	8.034	79
2010	12.685	8.534	1.453	9.987	86
2011	13.900	9.674	2.310	11.984	>90

Initiative “KIVA” at TU Darmstadt supported by Quality in Teaching Pact

KIVA – Kompetenzentwicklung durch interdisziplinäre Vernetzung von Anfang an:

- “Competence Development by Interdisciplinary Cooperation from the beginning”
- Successful project in the nationwide competition “Quality in Teaching Pact”: five years (2011-2016), 13 million Euro
- Objectives:
 - (1) to intensify interdisciplinary cooperation in teaching,
 - (2) to increase student commitment,
 - (3) to encourage more young people to study the STEM disciplines (KIVA focuses on the introductory phase of students’ university careers).

KIVA Sub-Projects

Implementation in six sub-projects:

KIVA I

Strengthening of
mathematical skills

KIVA II

Funds for Visiting
Professorships

KIVA III

Strengthening of
Study Offices

KIVA IV

Expansion of
trainings for tutors

KIVA V

Interdisciplinary
First-Year Student
Projects

KIVA VI

Development of
Interdisciplinarity

KIVA V: Interdisciplinary projects in the introductory phase

Our goal: integration of interdisciplinary study projects in the curricula of all undergraduate programs at the TU Darmstadt

Concept: Students of Engineering, Sciences and Humanities work together in teams (Coaching is essential)

Project work is hard but will forge students into long lasting study groups

We want the students:

- to be introduced into one's own discipline
- experience a cooperation beyond its own borders
- solve complex and societally relevant tasks
- strengthen the bond with teachers and fellow students

Interdisciplinarity project work causes:

- strengthen the intrinsic motivation for study
- social issues are handled in the disciplinary context
- Networking between professors

„Meeting Point Mathematics“ at TU Darmstadt

- Optional offer of the department of mathematics
- Since 2009 offered to mechanical engineering students
- Expansion 2011: electrical engineering, civil engineering, computer science
- Supporting lectures and seminars through subject matter repetition and exercises
- Show fields of application and point out the relevance of the subject
- Supplemented by exam preparation classes

Conclusions

- There has been a strong structural change to the new bachelor and master programs in engineering.
- The structural change did not automatically lead to a better success rate.
- A lot of activities have started to reduce drop-out and improve teaching.

→ But:

- We need convenient solutions.
- We don't yet know how successful our activities are.
- We need reliable financing.

A young man with dark hair, wearing a green ribbed sweater, is seated in a lecture hall. He is looking towards the right, resting his chin on his right hand, and writing in a white notebook with a pen. The background shows other students in a dimly lit room with wooden slatted seating.

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Thank you!

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