

# Opportunities and Challenges for Education on Standardization in Universities



SCSC Project Advisory Group on Education Joint Meeting  
with the American National Standards Institute Committee on Education

“Opportunities and Challenges for Education on Standardization in Universities”  
Ronald Reagan Building and International Trade Center  
1300 Pennsylvania Avenue, Washington, DC, United States

February 28, 2011

## The challenges of the markets for education in standardisation at university level

**Prof. Dr. Ing. Wilfried Hesser**

Department of Standardisation and Technical Drawing/CAD ([www.pro-norm.de](http://www.pro-norm.de))

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With many thanks to Prof. Dr. Blind, Prof. Dr. Müller, Prof. Dr. de Vries, Mr. Behr, Daimler AG, Mr. Wendt, Microsoft, Mr. Reigl, Siemens and Ms. Freericks, DFKI for valuable advice

# The challenges of the markets for education in standardisation at university level

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## Contents

- 1 Investigations of the standardisation services department in German companies
- 2 Job offers analysis:  
USA , Canada, UK, Australia, United Arab Emirates
- 3 Standardisation and how to teach it
- 4 Contents of education in standardisation
- 5 Annex

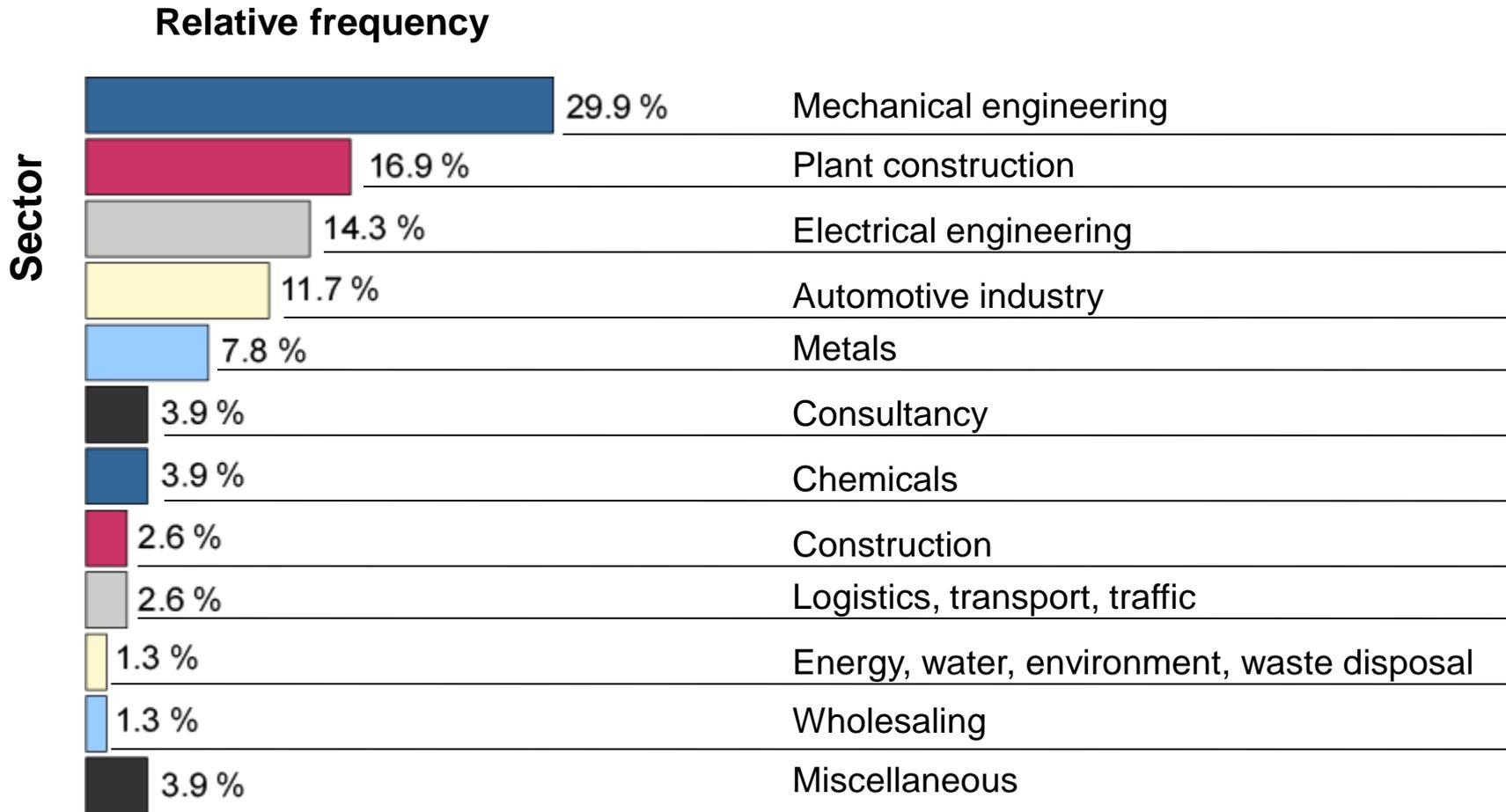
# The challenges of the markets for education in standardisation at university level

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**What expertise in standardisation is demanded in German companies?**

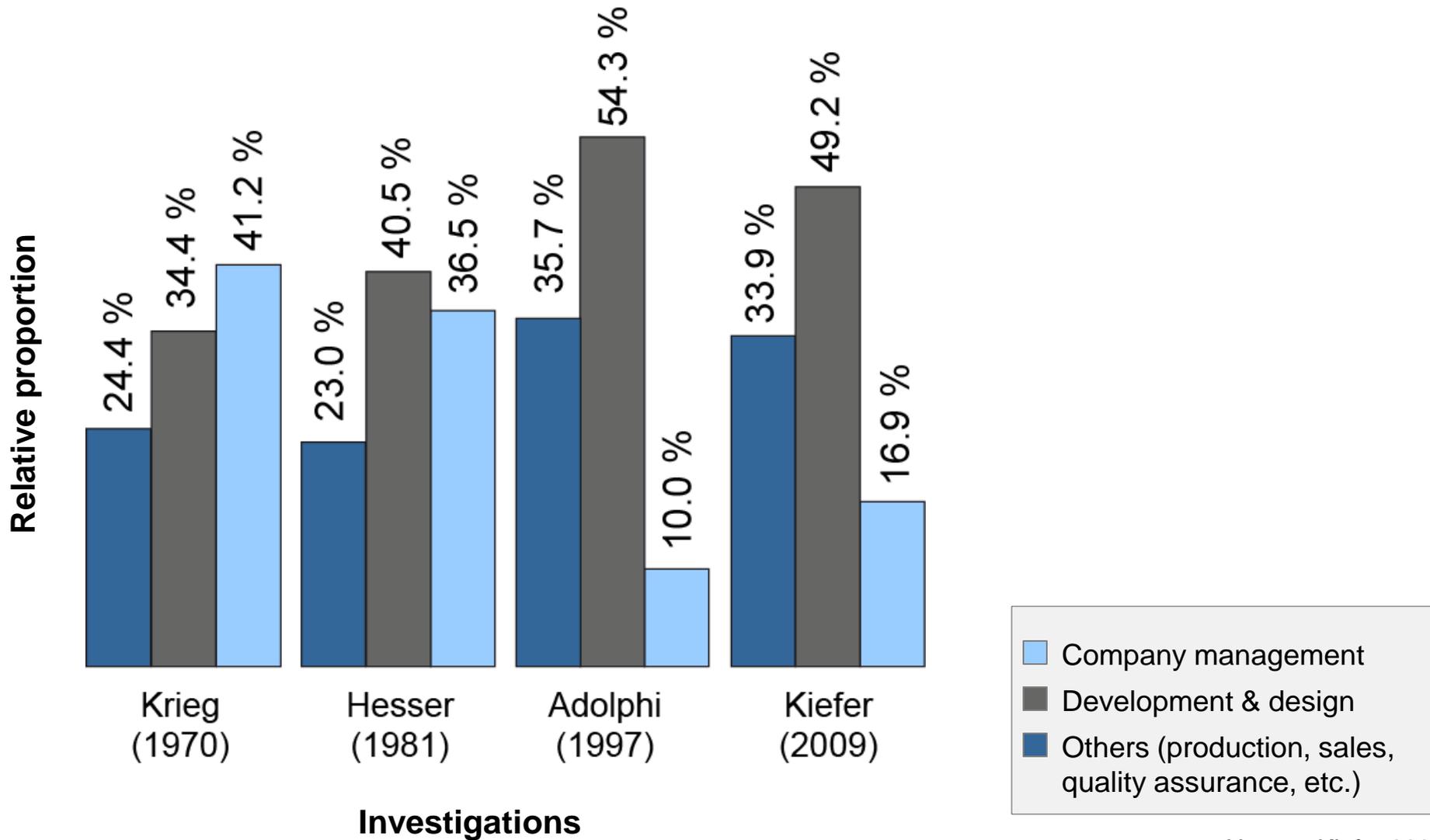
# The sectors of the companies investigated

77 companies = 100%



Hesser, Kiefer 2009

# The organisational integration of the standardisation services department



Hesser, Kiefer 2009

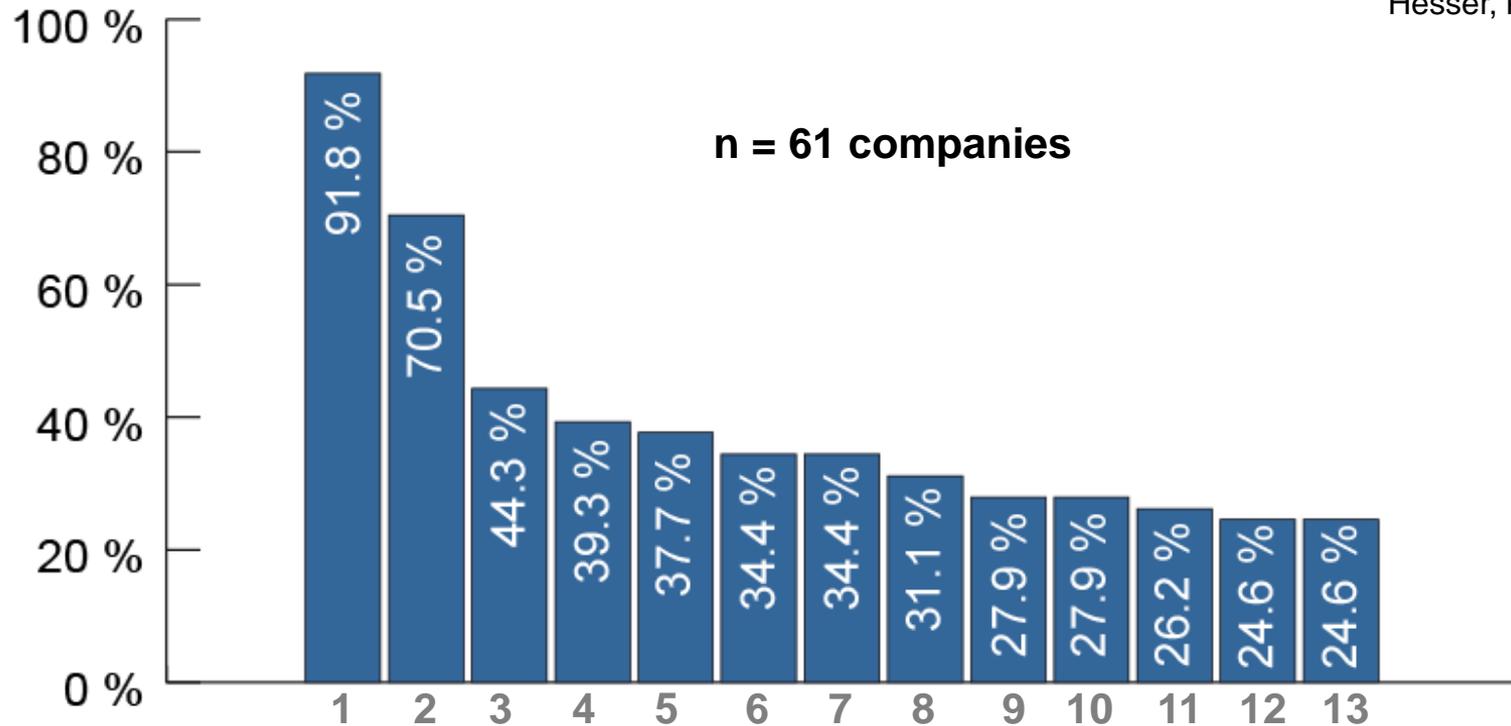
# A breakdown of the strategic functions of the standardisation services department

	Krieg (1970)	Hesser (1981)	Adolphi (1997)	Kiefer (2009)
Strategic function	41.2 %	36.5 %	10.0 %	16.9 %
Operational function	58.8 %	63.5 %	90.0 %	83.0 %

Hesser, Kiefer 2009

# The principal tasks of the standardisation services department at present

Hesser, Kiefer 2009



[1] Drafting/creating in-company standards

[2] Consultancy for specialist departments

[3] Involvement in nat. standardisation committees

[4] Creating tables of product characteristics

[5] Change management control

[6] Inspection of drawings

[7] Involvement in internat. standardisation committees

[8] Evaluation of EC Directives

[9] Duplication, archiving

[10] Evaluation of nat. standardisation activities

[11] Management and creation of master data

[12] Technical product documentation

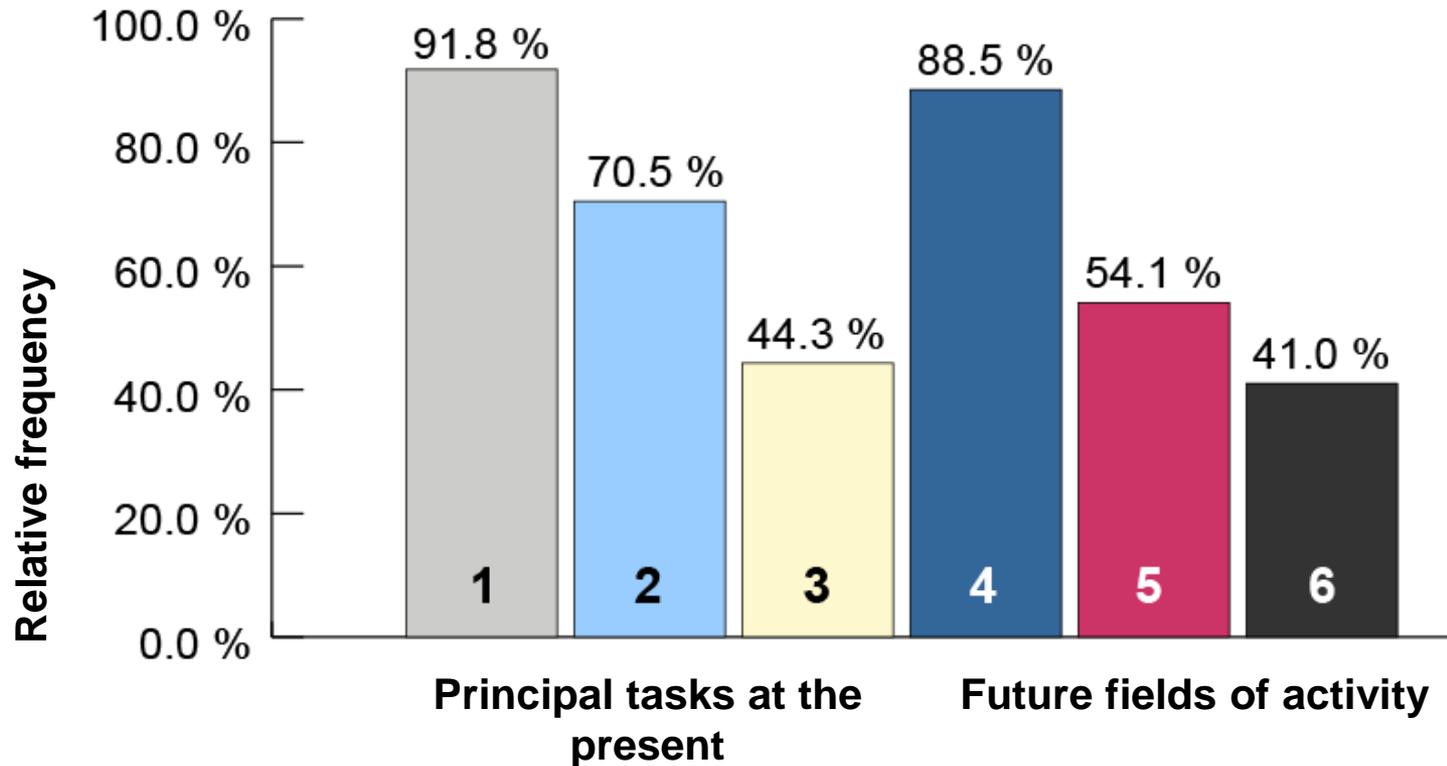
[13] Evaluation of internat. standardisation activities

# Overview of the principal technical and IT-specific duties for the standardisation services department

Technical tasks	IT-specific tasks (SAP; CAD; PDM)
Drafting/creating in-company standards	Technical product documentation
Consultancy for specialist departments	Creation and management of parts classifications
Evaluation of EC Directives	Change management control for technical drawings
Evaluation of national standardisation activities	Duplicating and archiving of technical drawings and standards
Evaluation of international standardisation activities	Creating and managing tables of product characteristics
Consultancy for the company management	Creating and managing master data, e.g. creating parts lists
Involvement in national standardisation committees	Inspection of technical drawings
Involvement in international standardisation committees	

# A comparison of the present and future principal tasks of the standardisation services department

Comparison between principal tasks at present and future fields of activity

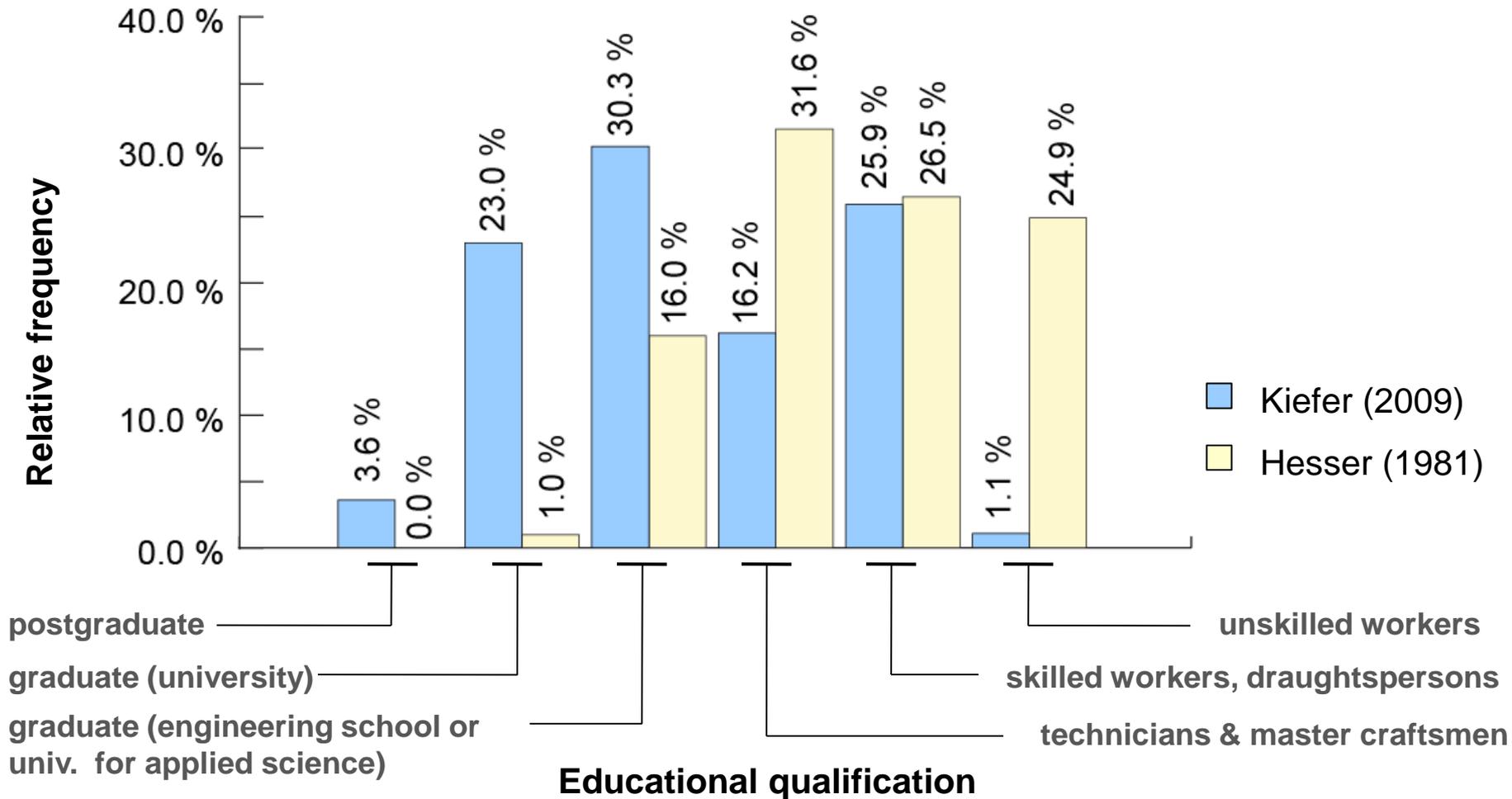


- [1] Creation of in-company standards
- [2] Consultancy for specialist departments
- [3] Involvement in nat. standardisation committees

- [4] Consultancy for specialist departments
- [5] Technical product documentation
- [6] Collation of industry-wide information

Hesser, Kiefer 2009

# Statements on the educational qualification of employees in the standardisation services department



Hesser, Kiefer 2009

# Job offers analysis: USA , Canada, UK, Australia, United Arab Emirates

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**Carla Freericks** [Analysis period: April to August 2010; Job Offers used for analysis (74): USA (concentrated), Canada, UK, Australia, United Arab Emirates; Telephone calls: 22 (20 USA, 1 Canada, 1 UK)]

## **Facts about the standards engineer career :**

More than 100 jobs offers for standards engineer (SE) positions

## **Educational requirements**

**Specific engineer degree or equivalent B.Sc.** (industrial, electrical, chemical, informatics, etc...) with additional experience in standards (sometimes experience in a particular standard) and respective standardisation issues.

## **Demanded responsibilities**

- A) Be aware of / interpret standards
- B) Standards development: company's internal stds, de facto stds or formal stds.
- C) Standards implementation
- D) Standards compliance/certification/inspection/evaluation
- E) Standards diffusion / Training

# Job offers analysis: USA , Canada, UK, Australia, United Arab Emirates

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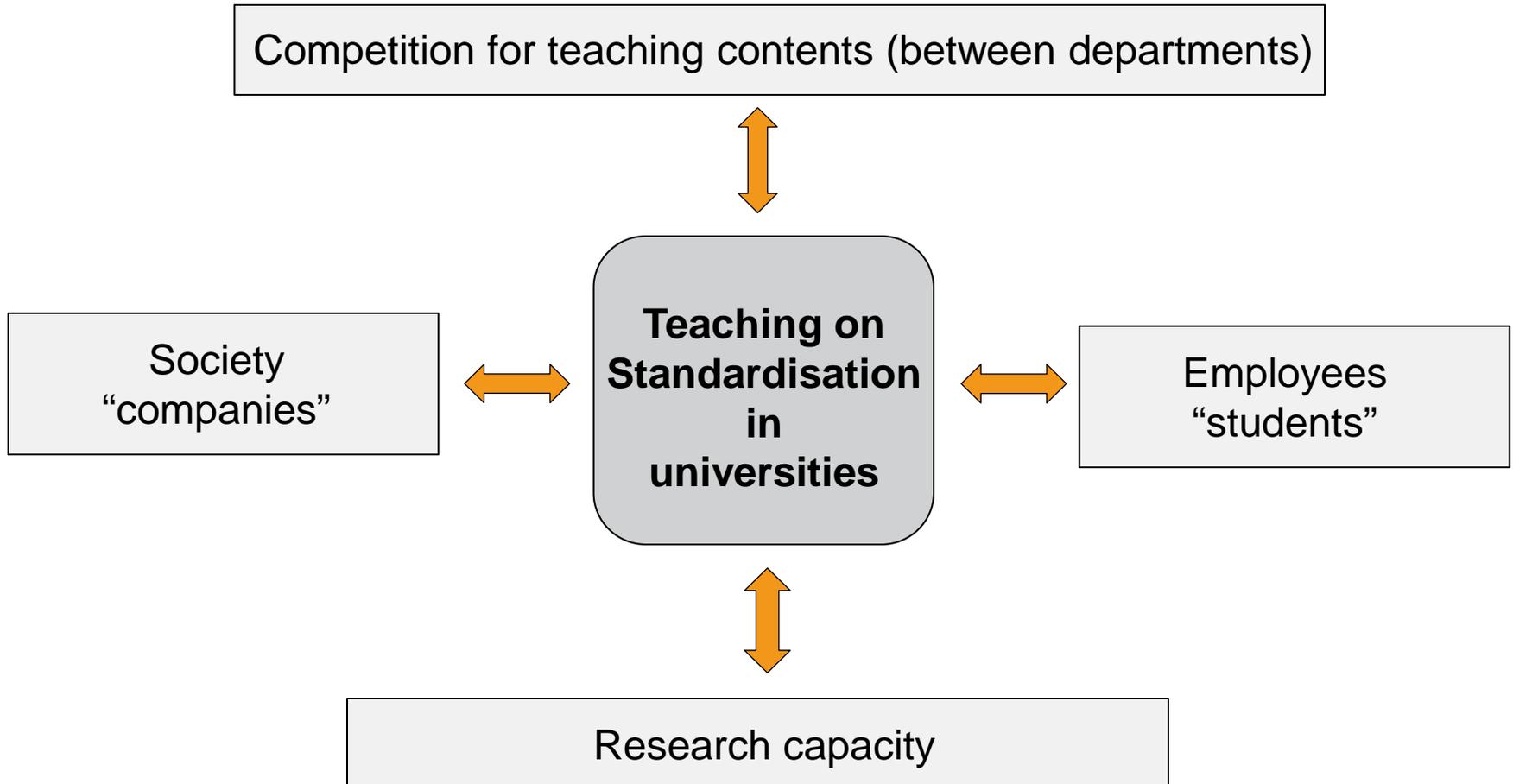
**Carla Freericks** [Analysis period: April to August 2010; Job Offers used for analysis (74): USA (concentrated), Canada, UK, Australia, United Arab Emirates; Telephone calls: 22 (20 USA, 1 Canada, 1 UK)]

## **Demanded skills**

“Diplomatic abilities”, “Communication abilities”, “Explanatory skills”, “Writing skills”, “Language skills”, “Convincing/motivating others to make/employ standards”, “Problem/conflict solving abilities”, “Sensitive to other cultures, needs and backgrounds”, “Patience & endurance/perseverance”, “Decision making capability”, “Evaluation skills/ Analytical abilities”, “Ability to build consensus”, “Technical leadership”, “Change management skills“, etc.

**Challenges in implementing education for standardisation at  
European universities  
and  
What contents should a course in standardisation at  
universities have?**

# Standardisation and how to teach it



# Standardisation and how to teach it

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## Integrating a new course into a university infrastructure

### There are always issues with:

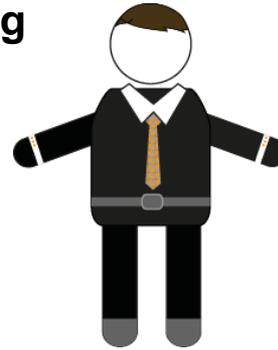
- integration into a faculty
  - the competition for securing students
  - the competition for permanent academic posts (job)
  - the competition for rooms
  - the competition for financial resources
  - the competition for research funding
- Furthermore,
- the requirements of society, industry and business, but also those of the students have to be taken into account

# Standardisation and how to teach it

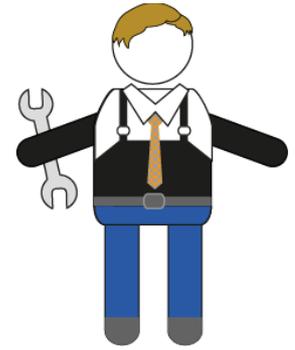
## Incorporation of standardisation into teaching

### Target groups

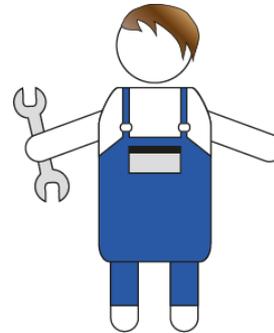
- University teachers
- Postgraduate students
- University graduates
  - Engineering science
  - Economics
  - Sociology
  - Agriculture
- Training for technicians / master craftsmen
- Technical grammar schools



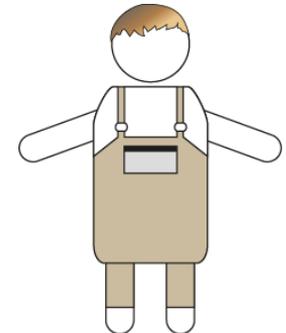
Manager



Engineer  
Business  
Administration



Engineer  
Member  
**TC**



Engineer  
Staff member  
Standardisation  
Department

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TU Clausthal

## Published curricula by

Donggeun CHOI → Korea

Henk de Vries → Rotterdam School of Mgmt.

Müller → TU Clausthal

Blind and Gaub → TU Berlin

Hesser → HSU HH

# Standardisation and how to teach it

## Contents of education in standardisation – 3 Types

### Company Standardization

- Developing size range and modular products
- Structure and effect of subject number systems
- Methods of the reutilisation of existing solutions
- Standardization of CAD systems and their environment
- Standardization of manufacturing techniques and equipment
- Standardization and quality management
- Standardization and company information systems

### Formal/ Industry Standardization

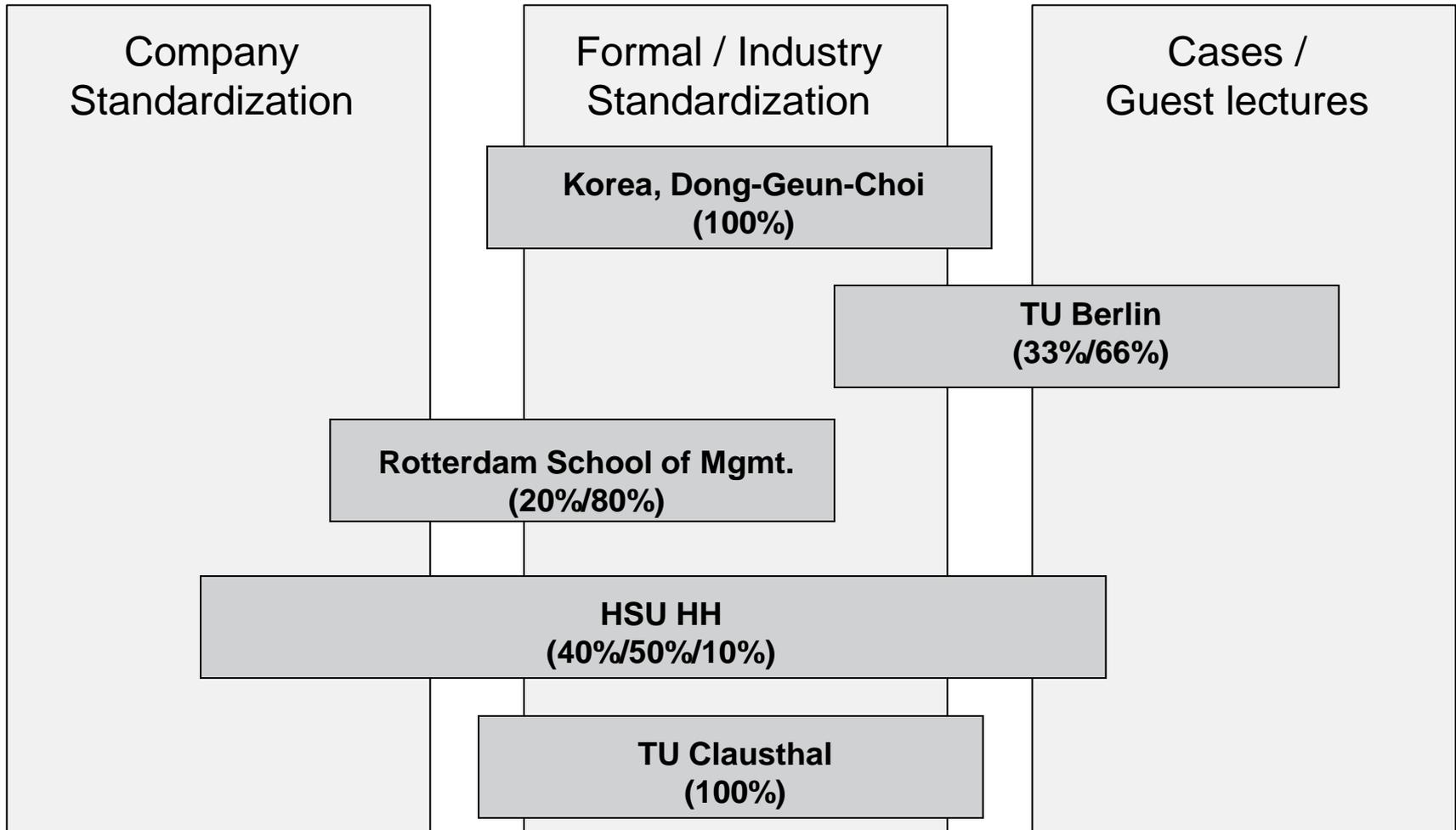
- History of standardization
- Knowledge of the work of standards organizations
- Fundamentals of standardization/basic knowledge of national, European and international standardization
- Standardization work in the European and international standardization committees
- Benefits of standards for national economies and businesses
- Legal effect of standards

### Cases / Guest lectures

- Knorr-Bremse für Schienenfahrzeuge GmbH, Dr. Schlosser (Guest Lecturer)
- ASTM American Society for Testing and Materials, Ms. Kathie Morgan (Guest Lecturer)
- BAM Federal Institute for Materials Research and Testing Bundesanstalt für Material und –prüfung, Dr. Nitsche (Guest Lecturer)
- CE marking, Dr. Schacht (Guest Lecturer)
- DIN Software GmbH, Mr. Kölling/Dr. Schacht (Guest Lecturer)

# Standardisation and how to teach it

## Contents of education in standardisation – 3 Types



# EU Standardisation in Companies and Markets (1)

## Prof. Dr.-Ing. W. Hesser

Target Qualifications			
Content	Engineer	Business-Administration	Government officials
Fundamentals of Standards and Standardization	X		
An Introduction – The History of Standardisation		X	X
Economic Aspects of Standardization		X	X
Development of Standards	X		
Standardization in Product Development and Design	X		
Standardisation within a Company - a Strategic Perspective	X	X	
External Standardization as a Company Strategy		X	
Standardisation Strategies of Firms		X	X
Standardization and Innovation	X		
Standards Consortia		X	X
ICT Standardisation	X	X	

# EU Standardisation in Companies and Markets (2)

Prof. Dr.-Ing. W. Hesser

Target Qualifications			
Content	Engineer	Business-Administration	Government officials
Challenges and Approaches of efficient Formal Standardisation		X	X
International Standardization		X	X
Standardisation and International Law			X
The European Standardization Regulatory Framework	X		
The Standardization Policy of the European Union		X	X
Standardisation and Law in the Federal Republic of Germany		X	
The European Union and its New Approach	X		
Conformity Assessment	X		
Metrological Measurement	X		
Case Study: Quality Management Methods and ISO 9000 Quality System Certification	X	X	X
Case Study: Implementation of the ISO 14000 Environmental Management System		X	X
Case Study: Agricultural Standardization			X

## Success factors

- Publicity for lecture (internal in university)
- Teaching/study concept (lectures, seminars)
- Excellent documents for teaching concept
- Exercises (with practical examples, excursions)
- Supervision of exercises
- Guest lectures (representatives: industry, commerce, NSB)
- Ambitious, interesting Bachelor and Master theses
- End-of-course party

## Success factors

- Develop a national research program for standardisation
- Develop a website: containing tools to teach standardisation and not only PowerPoint presentations, but excellent teaching material
- Develop a national network for teachers, who are interested in teaching standardisation

- Prize for “Young academics” awarded for
  - Bachelor, Master theses
  - Postgraduate theses

# The challenges of the markets for education in standardisation at university level

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For further information to our lecture program  
Standardisation please visit the website

[www.pro-norm.de](http://www.pro-norm.de)

## Thank you for your attention!

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## 5. Annex

# Levels of education in standardisation at technical universities and universities of applied science

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1. **Master course of study** Standardisation  
e.g. Master's degree course  
(3 – 4 semesters)
  - Prerequisite: **Bachelor's degree course**
    - Business Administration and Economics
    - Engineering sciences
  - Required: min. 15 students/year;  
2 professors
  
2. **Principal subject** Standardisation in Bachelor's and Master's degree courses  
  
Scope: 6 – 12 hours per week 9 – 18 CP (credit points)  
Possible courses of study:
  - Business Administration and Economics
  - Engineering sciences
  - Required: 10 students as a minimum,  
1 professor

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# Levels of education in standardisation at technical universities and universities of applied science

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- 3. Compulsory subject** in Bachelor's or Master's course
- Scope: 2 – 3 hours per week 3 – 5 CP (credit points)
- Possible courses of study:
- Business Administration and Economics
  - Engineering sciences
- Required: 10 students as a minimum, 1 professor
- 4. Compulsory option** in Bachelor's or Master's course
- as 3.
- Required: 10 students as a minimum, 1 professor or part-time lecturer
- 5. Subsidiary option** in Bachelor's or Master's course
- as 3.
- Required: 10 students as a minimum, 1 professor or part-time lecturer

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# Levels of education in standardisation at technical universities and universities of applied science

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## 6. **Incorporated into existing teaching sessions**

- Basic knowledge of standardisation in lectures, such as:
  - Product development
  - Design theory
  - ...

## 7. **Specialised standards knowledge in application-based teaching sessions such as:**

- Design features
- Quality assurance
- Plant construction
- ...

## 8. **Lecture series**

- Scope: 3 x 1.5 hours
- Part-time lecturer, presenter

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## University teachers, postgraduate students, university graduates (Different focuses depending on subject area)

- History of standardisation
- Knowledge of the work of standards organisations
- Fundamentals of standardisation/basic knowledge of national, European and international standardisation
- Role of standardisation in the European Union (incl. EU Directives/New Approach)
- Standardisation work in the European and international standardisation committees
- Benefits of standards for national economies and businesses
- Strategic importance of standardisation (national and global market)
- Legal effect of standards
- Acquisition of information via standards
- Specialised information

**Module type:** Subsidiary option

ECTS 6

2 Semester

**Bachelor and Master:** mechanical engineering and industrial engineering

## Teachers Graduates from technical colleges, (Different focuses depending on subject area)

- History of standardisation
- Fundamentals of standardisation/basic knowledge of national, European and international standardisation
- Benefits of standards for business
- Strategic importance of standardisation (national and global market)
- Legal effect of standards (incl. EU Directives/New Approach)
- Standardisation work in the European and international standardisation committees
- Acquisition of information via standards
- Specialised information on standards

**Module type:** Subsidiary option                      ECTS 6    2 Semester

**Bachelor:** mechanical engineering and industrial engineering

# Lecture Standardisation – Content

## TU Berlin, Prof. Dr. Blind and Dipl. Ing. Gaub (DIN)

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In the course of the lecture, formal standardisation is explained as a strategic element relevant for the economy and society, by reducing barriers to trade, enhancing the marketability of innovations, etc.

Formal standardisation contributes to technical knowledge and increased speed of diffusion of innovations.

Standardisation increases the probability of successfully placing innovations on the market, leading to increased competitiveness on the national, European and international levels.

Moreover, formal standardisation supports the development of new economic areas and opening of new markets.

On the one hand, this shows that stakeholders put great trust in the content of formal standards.

On the other hand, it also highlights the ability of stakeholders to shape standards by direct involvement in the process of standardisation.

*Guest lectures will be held by experienced experts active in the practice of standardisation.*

# Lecture on Standardisation Strategy can be included in the courses of study in the following manner\*:

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## TU Berlin, Prof. Dr. Blind and Dipl. Ing. Gaub (DIN)

- Master Innovation Management and Entrepreneurship: Wahlpflichtbereich (**Compulsory option**) 6 ECTS,
- Industrial engineering (Economic Engineering), (Diplom): Wahlpflichtbereich (**Compulsory option**); 4 SWS/6 ECTS,
- Industrial engineering (Master): **Compulsory option**; 6 ECTS,
- Industrial engineering (Bachelor): **Compulsory option**; h; 6 ECTS,
- Bachelor of Economics: **Compulsory option**; 6 ECTS,
- Master in Industrial and Network Economics: **Compulsory option**; 6 ECTS,
- BWL (Diplom): SBWL oder **Subsidiary**; 4 SWS, (Business administration)
- VWL (Diplom): **Subsidiary**; 4 SWS, (Economics)
  
- Can be selected in other Bachelor and Master courses in accordance with the examination regulations applicable to that course of study

\*) Credits apply to obligatory lecture and optional compact tutorial (each of 2 hours per week or 3 ECTS)

## Syllabus – Topics covered; Dipl. Ing. Gaub (DIN)

**10/21/2010:** Introduction - formal standards as strategic instruments, Mr. Gaub (DIN)

**10/28/2010:** The standardisation process for opportunities for stakeholder involvement

(lecture held at Normenwerk, DIN, Budapester Straße 31)

**11/04/2010:** Standardisation on the European and international levels, Dr. Gindele (DIN), (8.30 am - 10.00 am)

**11/11/2010:** Guest Lecturer: Ms. Kathie Morgan (ASTM American Society for Testing and Materials), [www.astm.org](http://www.astm.org) <http://www.astm.org/>

**11/18/2010:** Guest Lecturer: Mr. Kölling/Dr. Schacht, DIN Software GmbH

**11/25/2010:** The contribution of formal standardisation to efficient state governance and contract protection, Mr. Gaub (DIN)

**12/02/2010:** The contribution of formal standardisation to efficient state governance and contract protection. Formal standardisation as the codification of abstract goals (environmental and occupational safety), Mr. Gaub (DIN)

**12/09/2010:** CE marking, Dr. Schacht

## Syllabus – Topics covered; Dipl. Ing. Gaub (DIN)

**12/16/2010:** Guest Lecturer: Dr. Schlosser, Knorr-Bremse für Schienenfahrzeuge GmbH, [www.knorr-bremse.de](http://www.knorr-bremse.de) <http://www.knorr-bremse.de/>

**12/23/2010:** Free

**12/30/2010:** Free

**01/06/2011:** Standardisation and R&D: Innovation through informal standards

**01/13/2011:** Guest Lecturer: Dr. Nitsche, BAM Federal Institute for Materials Research and Testing Bundesanstalt für Material und -prüfung, [www.bam.de](http://www.bam.de) <<http://www.bam.de/en>>

**01/20/2011:** Formal standardisation as strategic instruments, Mr. Gaub (DIN)

**01/27/2011:** Guest Lecturer: Mr. Pace, Dentaurum GmbH & Co. KG

**02/03/2011:** Exam preparation

**02/10/2011:** Economic and management aspects of formal standardisation (with examples)

**02/17/2011:** Exam (closed-book and closed-notes)

ass. Prof. Dr. de Vries and Prof. Dr. Blind TU Berlin

- Masters elective, 10 ECTS, for students in the Master Management of Innovation
- Lectures, guest lectures, company visits, games, teaching cases, individual assignments, group assignments
- See: *ISO Focus+*, January 2010, pp. 44-47  
[http://www.iso.org/iso/iso-focus-plus\\_index/iso-focusplus\\_online-bonus-articles/the-2009-iso-award/2009-award\\_the-netherlands.htm](http://www.iso.org/iso/iso-focus-plus_index/iso-focusplus_online-bonus-articles/the-2009-iso-award/2009-award_the-netherlands.htm)

# Curriculum Prof. Dr. de Vries

- Introduction to standardisation
- Classifications of standards and innovations
- History of standardisation
- Standardisation at the national level
- Standardisation by industry associations
- Standardisation by industrial consortia
- Battles between competing standards
- Macro-economic impact of standardisation
- Impact of standardisation on industry sectors
- Impact of standardisation on companies
- Benefits and cost of participation in standardisation
- Standardisation and world trade (including the role of the WTO)
- Impact of standardisation on developing countries
- Standards and Intellectual Property Rights
- Use of company standardisation to improve the process of radical innovations
- Relating external standards and standardisation to the innovation process
- Impact of standardisation on innovation, both at company level and at sector level, and both for products, services, and complex systems
- Mathematical approach to standardisation: preference ranges
- Architecture of standards related to technology architecture
- Product variety management
- Standardisation in the field of services
- Standardisation in the field of management systems
- Standardisation for interoperability of ICT systems
- Standardisation and conformity assessment for sustainability
- Consumers and standardisation
- Standardisation for research organisations
- Conformity assessment: practices, problems and solutions
- Relations between legislation and standardisation (including the European 'New Approach', product liability, the use of standards in public procurement, anti-trust law)
- National standardisation policies
- Company standardisation policy
- How to organize and manage standardisation at company level?
- Standards bodies – practices and possible improvements

## Teaching Standardisation in Companies and Markets

Standardisation in companies and markets is taught as an optional subject in the 9th and 10th trimesters. Teaching takes place in the form of lectures and guided practical sessions. The teaching concept is divided into two main sections:

1. significance and uses of standardisation in industry and trade, and
2. general fundamentals of national and international standardisation,

with the underlying aim being to provide an interdisciplinary representation. During their studies students of mechanical engineering and industrial engineering should gain an understanding of the interconnections within the various parts of the production and economic processes that are affected by technical standardisation. A further aim is to impart an awareness of standardisation against the real background of an industrial and information society by illustrating how strongly standards influence individual areas of life and work.

**Module type:** Subsidiary option                      ECTS 8    3h per week    2 Trimester (24 weeks)

**Master:** mechanical engineering and industrial engineering

## **Section I Industrial Standardisation**

### **Part 1 Design and Standardisation**

1. History of standardisation
2. The basic principles of methodical design
3. Developing size range and modular products
4. Structure and effect of subject number systems
5. Methods of the reutilisation of existing solutions
6. Standardisation of CAD systems and their environment

### **Part 2 Manufacturing and Standardisation**

1. Standardisation of manufacturing techniques and equipment
2. Standardisation and transport - standardisation of material
3. Standardisation and quality management
4. Standardisation and company information systems

## Section II National and International Standardisation

### Part 1 General information: Basic principles, elaboration and organisation

1. Agreements and standardisation as basis for human coexistence
2. Definition and aims of standardisation
3. National, regional and international standards organisations
4. Standardisation work and standardisation processes
5. Standardisation and Economic theory
6. Standards and information systems

### Part 2 Standards application

1. The legal status of standards
2. Safety and standardisation
3. Certification of conformity with standards
4. Standardisation and the consumer