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EXPERIMENT AND REFORM IN GRADUATE EDUCATION THE GERMAN MODEL OF THE GRADUIERTENKOLLEGS

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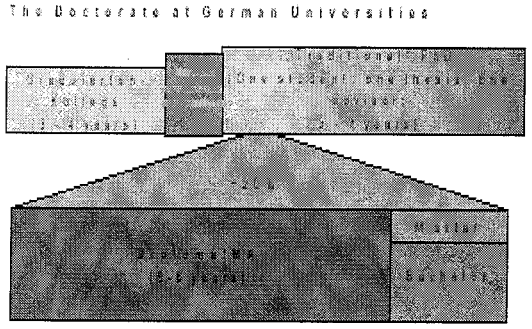
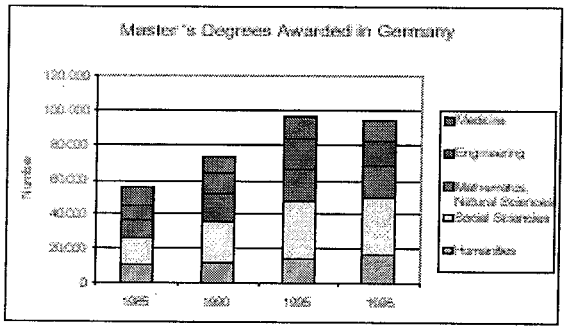
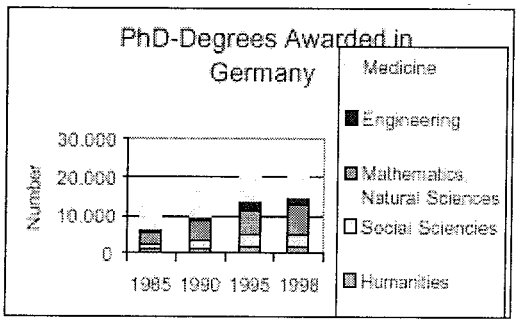
I appreciate the opportunity to introduce you to the Graduiertenkollegs, a programme for reshaping PhD training in Germany which has also developed into a new mode of international partnerships. To set the scene, let me briefly outline some facts about the PhD in Germany.



Outside the medical sciences, PhD training in Germany begins after approximately five to six years of undergraduate study, completed by the traditional German "Diplom" or, in an increasing number of cases, by a Master's degree, often following a BSc or BA. Overall, an average of 20% of graduates go on to take a PhD – according to subject, the rate varies from 10% to 80%. Around 90% of PhDs in Germany are still completed in the traditional "apprenticeship" mode. It is the remaining 10% that I would like to talk about today, those PhDs that receive their training in the context of a "Graduiertenkolleg".





Please note that in most cases, PhDs in the medical sciences are mostly qualitatively different from other PhDs, corresponding more to an MD degree. 7.2% of PhDs are taken by foreign nationals.

I. WHAT IS A GRADUIERTENKOLLEG?

A Graduiertenkolleg is a structured doctoral programme that is thematically focused.

Its scientific programme is proposed and directed by a group of 8-15 university faculty at a single university or a small consortium of universities. Extra-mural research institutes (e.g. Max-Planck Insitutes) are welcome to participate. A Kolleg involves 15-25 postgraduates working on their theses in the context of a coherent research programme and participating in a specially designed study programme. Many Kollegs also provide postdoc positions.

Thematic focus
Examples of some recently established European Graduiertenkollegs:
· *Institutionelle Ordnungen, Schrift und Symbole*
· *Neuroplasticity: From Molecules to Systems*
· *Combinatorics, Geometry and Computation*
· *Microstructural Control in Free-Radical Polymerization*

Graduiertenkollegs are subject to a competitive peer review process directed by the Deutsche Forschungsgemeinschaft, the national Research Council. This ensures that Graduiertenkollegs are established at centres of excellence in research. Their performance is evaluated in three-year intervals, their duration limited to 9 years – providing constant innovation in the programme, which is currently limited to 300 Kollegs in all subject areas. This limitation is a sensible corollary of focusing on fairly specific topics.

The study programme – an example
(Graduiertenkolleg Optoelectronics of mesoscopic semiconductors, Marburg)

- Lecture series (2 hrs/week)

This is intended to provide a common base of knowledge for the students. The subjects change regularly, the emphasis being on experimental and theoretical semiconductor physics and optics, polymer physics, preparation technology and applications.

- Annual block seminar

This is organised yearly by two students of the Graduiertenkolleg over 3-4 days. All students report on the progressof their theses, the evenings are devoted to talks on topics of common interest

- "Kindergarten"seminar

These are organised by the students themselves (without the advisers) in the term holidays. They treat basic scientific questions connected with the theses.

- Lectures by visiting scientists.

The Graduiertenkolleg has funds for inviting foreign and national scientists of international stature. They are chosen by the students according to their current scientific interests and problems

- Workshops

Twice a year the Graduiertenkolleg organises a workshop of several days' duration. They are devoted to a single topic, on which scientists from other institutions are asked to give short courses of high didactical standards.

Key features of this scheme are:

- The students' theses are integrated into an overall research programme (often interdisciplinary) which is a main focus of the peer-review exercise. This ensures the scientific standard and relevance of the theses and gives the students the opportunity and incentive to interact and cooperate, enhancing their theses as well as their transferable skills.

- The study programme can be tailor-made to suit the specific needs of the student group – their input into its design and management is encouraged. It should provide participating students with a broad methodical orientation and a common basis of skills and knowledge. It is expected to go well beyond a standard coursework programme, incorporating elements such as regular seminars, a visiting researchers programme, summer schools, workshops, block courses, lab rotations, industrial contacts, as well as instruction in supplementary skills such as languages, rhetorics, paper-writing, media training, etc.

- In this context an individual will receive constant feedback on the progress of her/his thesis; many Kollegs make a rule of installing two advisors for each thesis.

A good Graduiertenkolleg will thus create a communicative and absorbing research environment for the students as well as for the university faculty involved.

II. DEVELOPMENT AND EFFECTS OF THE PROGRAMME

After its inception in 1990 the programme has been built up to include some 300 Graduiertenkollegs in all disciplines. Humanities have a particular emphasis.

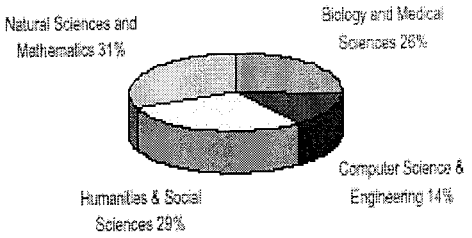


Diagram: *Graduiertenkollegs by main subject area*

Some 10% of German PhDs are now completed by participants in a Graduiertenkolleg.

Significant effects achieved by the programme are:

- Lower completion times.

Average time-to-degree in a Graduiertenkolleg is definitely also well below the usual duration (which is closer to 5 years than 4).

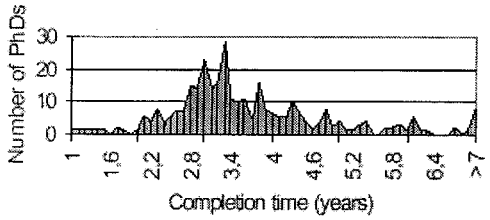
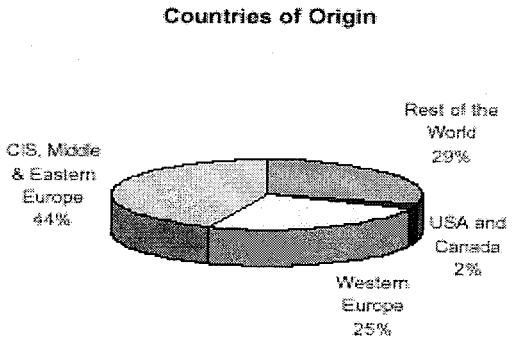


Diagram: *Completion times for PhDs in Graduiertenkollegs*



Diagrams: *Participation of foreign students in Graduiertenkollegs*

- Lower average age at completion

This is still too high at 30.1 years, but 2.2 years below the national average.

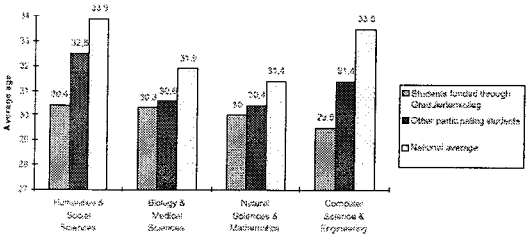
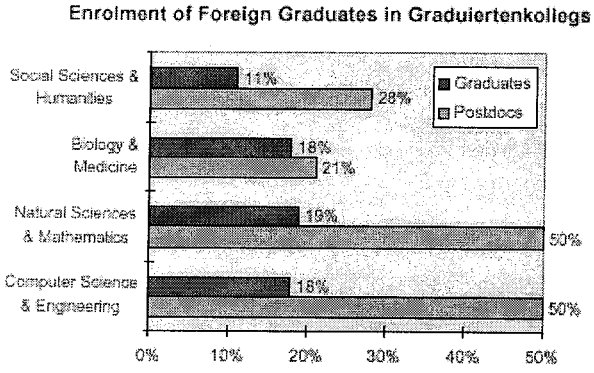


Diagram: *Average age at completion of PhD*

- Better-trained PhDs, due to better and more appropriate training.

We have a lot of positive feedback on this and are initiating a study.

- A significant contribution to international participation and cooperation, which has led to the establishment of European Graduiertenkollegs.



- Reform of the PhD system – the primary goal of the programme was to provide a model for reforming PhD-training in Germany. Slow in coming, other forms of structured doctoral training are now beginning to appear, e.g. the Max Planck International Research Schools and other Graduate

School-type initiatives in some of the German Länder.

Graduiertenkollegs have also contributed to modernising the PhD at the university and department level and have also influenced some disciplines – they are, e.g., connected to projects designed to provide research-oriented doctoral training to medical students.

III. ANALYSIS

We believe these successes are at least partly attributable to the fact that the programme has been operated in a learning mode. At its outset, the requirements set by the Deutsche Forschungsgemeinschaft for establishing a Graduiertenkolleg were open and flexible. The main requirements were scientific excellence and a study programme going significantly beyond traditional doctoral education in the subject(s) involved. The Deutsche Forschungsgemeinschaft encouraged experimentation in this respect By involving faculty members with a strong interest in graduate training and by giving room and funding to initiatives on the part of the PhD students themselves, Graduiertenkollegs were able to explore many new avenues in the practice of doctoral training in Germany and the programme produced a number of initiatives that were not envisaged at its inception:

• Graduiertenkollegs involving several universities

• A "virtual" Graduiertenkolleg (http://www.vgk.de)

• Graduiertenkollegs co-operating with industrial researchers

• Graduiertenkollegs at "non-classical" universities (e.g. Arts and Design)

• "international" Graduiertenkollegs.

A necessary by-product of experimentation are failures – some 10% of all initiatives were discontinued: in some cases because the faculty members involved were no longer prepared to continue their co-operation or to accept with the work-load, in most cases, however, because the peer-review process declared their performance inadequate. The most frequent reason given here was insufficient cohesion in the research done by the PhD students, often due to a lack of effort on the part of the senior researchers to achieve and maintain the focus of the research programme.

IV. LESSONS

The elements of

- excellence
- flexibility
- inducement to experimentation

have contributed significantly to the perceived success of the programme in providing a model and standards of achievement for the reform of graduate education in Germany. Remember that the universities in Germany are the responsibility of the 16 individual *Länder* (States) and PhD graduation is very often even a prerogative of the university departments, so that the barriers to uniform change imposed centrally are practically insurmountable.

Nevertheless, the model has gained ground too slowly because of some flaws in the design of the programme, and some of the lessons we learnt are:

• *Provide more incentive for university faculty*

The additional effort of advising, training and teaching PhD students in a Graduiertenkolleg is considerable; planning and co-ordinating the Kolleg's activities places an extra burden on university teachers, for which there is no compensation. The only "reward" for participating faculty members was the addition of students (often only one) to their group. (It is interesting to note that in the US the NSF's IGERT-programme is making a similar experience.)

• *Provide attractive stipends for students*

Stipends provided for students in the Graduiertenkollegs were and are considerably less attractive than the salary a research assistant also working on her/his thesis would receive. This was in part offset by the superior training environment, but students developed no understanding for the fact that they achieved a lower income than their peers and no social security benefits although they were selected as and expected to be special achievers.

• *Provide sufficient research funds*

Graduiertenkollegs provide substantial funds for travel and international contacts, made even more attractive by the fact that students are encouraged to participate in funding decisions. For technical reasons, they are very short on actual research funds for apparatus, consumables, etc. This has often proven a hindrance, sind this necessitated additional grant-raising efforts.

V. INTERNATIONALISATION

The decisive impetus for reform in doctoral training came in recent years when German universities and researchers realised that they must attract foreign students and that the current degree system was a major hindrance in this respect. Reforms started on the first-degree level with the introduction of Bachelor- and Master-Degrees. The success of the Graduiertenkollegs in attracting foreign students (see above) then led to the process of establishing Graduate Schools that began in the Max Planck Society and in the *Land* Lower Saxony last year. It is now continuing in a number of other German *Länder*; in each case, the initiators draw heavily on the experiences made in the Graduiertenkolleg programme.

Further information on the Graduiertenkollegs programme can be found at

http.//www.dfg.de/foerder/grako/zahlen.html

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