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Experience gained from the international Master Programme "Water Resources and Environmental Management (WATENV)" at Leibniz Universität Hannover

German universities offer several international master programmes in the field of water resources management. These programmes are very attractive for students from developing countries. Assuming that the graduates will continue their career in a developing country or in an international organisation, such master courses can contribute to capacity development. Leibniz Universität Hannover started the international master programme "Water Resources and Environmental Management (WATENV)" in 2009. In this paper, first experiences with that programme are presented. Admission procedure and work with the students differ considerably from the inland programmes. The curriculum focuses more on development-related content and training of soft skills. International networking and development competence could also be greatly improved in favour of German students.

Keywords: Capacity development, hydrology, internationalization, master, water resources management

1 Introduction

In the wake of globalisation, the internationalisation of German universities has gained momentum. This fact is mirrored in the strategies of the German Rectors' Conference (Hochschulrektorenkonferenz (HRK) 2008) and of the individual universities as well as in support programmes to expand international networking and cooperation. An international master programme may actively contribute to the internationalisation targets of the universities following HRK (2008). Central elements of HRK are promoting mobility and interculturality of students and scientists and granting professional support to foreign students. In the field of hydrology and water management several international master programmes, most of them taught in English language, have been created in recent years. To name just a few:

- Technische Universität Dresden: Hydro Science and Engineering
- Universität Duisburg-Essen: Water Science, additionally in cooperation with Radboud University Nijmegen: Transnational Ecosystem-based Water Management (TWM)
- Leibniz Universität Hannover: Water Resources and Environmental Management (WATENV)
- Fachhochschule Köln: Technology and Resources Management in the Tropics and Subtropics (TERMA)
- Universität Stuttgart: Water Resources Engineering and Management (WAREM)

Water is a major issue in the development goals of the United Nations. In many countries, especially the least developed ones, there is a high need for capacity development. In the long run, capacity development involves improving training on-site by means of establishing study courses on an international level. Cooperations between universities from differently developed regions might also contribute to this end (e.g. see JONKER et al. 2012). A higher qualification of bachelor graduates from developing countries through participation in quality-assured

master courses in well-resourced universities of highly developed countries can also contribute to capacity development, either by means of providing training capacity or by contributing to the internalisation of the developing countries. The qualified professionals – who studied at German universities and are globally cross-linked via their international fellow students – returning to developing countries can act as multipliers in their home countries and initiate positive changes, both in their field of study as well as in the on-site training of further experts. However, cases of educational migration from the developing countries may also happen. This is not desirable in terms of development policy but it cannot be prevented by the universities.

The present abstract aims at presenting the international Master Programme WATENV at the Leibniz Universität Hannover while using the latter as an example for elaborating on the aspects of internationalising university teaching.

2 Challenges and particularities compared to the engineering training of educational residents

Curriculum and examination regulations of the international Master Programme WATENV

The international Master Programme WATENV was first offered in the winter term 2009/2010 at the department of civil engineering and geodesy of Leibniz Universität Hannover. Between 2009 and 2012 a total of 69 students from more than 30 countries took up their studies in Hannover (fig. 1).

WATENV is a research-based attendance study course selectable directly following the bachelor graduation or after having gained first work experience in the water sector. The master programme is intended to provide water management experts with a profound basic knowledge of other disciplines and abilities for interdisciplinary cooperation. The curriculum calls for a focus on either one of the two areas of specialisation, i.e. "water resources management" or "sanitary engineering",

each of which then account for a large share of credits. Further teaching content includes basic knowledge in the neighbouring scientific disciplines as well as working methods (so-called Soft Skills). By selecting optional subjects, students can decide whether to evolve more towards specialisation via focusing on their area of specialisation or rather towards generalisation via interdisciplinary contents. This complies with the T-shaped competency profile according to UHLENBROOK & DE JONG (2012).

The areas of study in WATENV (fig. 2) are presented following the outline of the German-language master programmes in HABERLANDT & MÜLLER (2013). The shares of study programmes in hydrology and water management as well as in geosciences are similar to the German-language study courses in engineering sciences. Urban water management and the other "related water subjects", i.e. primarily fluid mechanics, hydraulic engineering and coastal engineering, are represented slightly lesser than on average in the German-language engineering courses, but much stronger than in the geo- and environmental sciences and hydrology. The interdisciplinary character of WATENV is reinforced by a study programme in environmental economy. Additionally, modules for generic qualification are offered, notably teaching basics of scientific work. Language courses are also part of the offer, these are not included in the numbers in figure 2.

As a special feature of the international study course distinguishing it from the German-language study programmes in Hannover, adaptation modules were introduced in the first term, aiming at repeating and deepening essential teaching content of the bachelor course in civil and environmental engineering. A relation to developing countries is established in several classes as well as in the range of topics for project papers and master theses that are often part of international research projects and may contain field studies in developing countries.

WATENV's examination rules are guided by comparable study programmes held in German. A special feature in the implementation of the rules is the fact that hardship provisions are more frequently asked for, as a premature termination of the studies may entail drastic consequences for scholarship students from developing countries. The scholarship contracts often include an obligation for repayment in the event of a self-inflicted termination of the studies. Due to the enormous gap in purchasing power compared to the developing countries, the cost of life in Germany is so high that repaying the cost of an entire academic year may ruin a university dropout's family. Therefore, the final failure of an examination constitutes a hardship case for students from developing countries rather than those from developed countries. This places the examiners in a

dilemma. On the one hand they want to avoid excessive rigidity, on the other hand, they have to treat all students as equal and must not jeopardise the quality of the training and hence the value of the final degree in the interest of all graduates. Based on single decisions, an additional repetition of an examination has been granted twice to date, while in spite of possible unpleasant consequences for the students, an exclusion from the programme had to be imposed. In the meantime, the two first-mentioned students were able to successfully complete their master course. To prevent such situations, a projection for the completion of the studies in the admission procedure is required as well as offers for a rapid integration at the beginning of the term.

Funding programmes for students from developing countries

Students from developing countries coming to Germany usually require financial support. By means of a special programme, DAAD promotes post-graduate courses for young specialists and executive staff from developing countries (AST, see DAAD 2012). The master courses fostered by the AST programme (funded by the Federal Ministry for Economic Cooperation and Development) provide training in subject areas whose competence enhancement is of vital importance for the sustainable development of the sending countries. AST scholarship students for WATENV have at least 2 years' work experience, primarily in authorities, ministries and other governmental or non-governmental organisations in the water sector, and are to be prepared for a subsequent international or transnational cooperation. In addition to WATENV, the abovementioned water-related courses in Cologne and Dresden are also included in the AST programme.

Within the scope of the funding priority "Sustainable water management (NaWaM)" under the framework programme "Research for a Sustainable Development (FONA)", the Federal Ministry of Education and Research (BMBF) supports junior researchers from Kazakhstan, Mongolia, Iran, Jordan, Vietnam and Indonesia for a limited period of time by means of scholarships allocated by DAAD. In addition to WATENV and the above-mentioned study courses from Dresden and Stuttgart, the study programme "Water Science" from Duisburg-Essen is also represented.



Figure 1
Home countries of WATENV students from 2009 to 2012

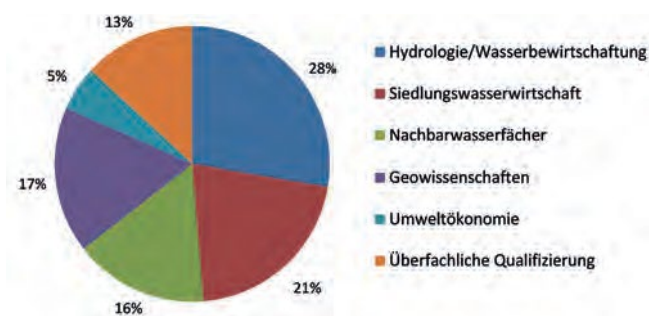


Figure 2
Distribution of the WATENV curriculum into study areas

The World Meteorological Organisation (WMO) pursues a scholarship programme ("Education and Training Fellowships Programme") for the further training of employees in meteorological and hydrological authorities of developing countries. As an offer for university post-graduate education, the WATENV master programme is exceptional.

Most scholarship programmes require administrative guidance by the university, notably by means of providing information, signing of cooperation agreements, adjustment of the admission procedure as well as the control of grants. Tied to the scholarship grants is mostly a great demand on the support of the students. The latter also results from the demands made within the scope of the National Code of the German Rectors' Conference and the universities' internationalisation strategies and therefore is of benefit to all students.

Due to its orientation, the WATENV study programme has a high share in applicants from developing countries and a correspondingly high share of scholarship holders (fig. 3) To date, 14 WATENV freshmen have been supported via DAAD-AST, 10 via WMO and 5 via NaWaM by means of full scholarships. Some students are individually funded by DAAD, national programmes such as Mekong 1000 in Vietnam or via their employers, families or loans.

Admission procedure

The initial numbers of applicants are about ten times higher than the number of available places to study, with more than half of the applications being unsuitable for approval. The admission procedure takes far longer than that of comparable domestic master programmes, as applications of the interested parties with several scholarship providers run parallel. Furthermore, the potential students must provide for sufficient time to be left for preparatory work such as a visa application after having been granted a place to study. Depending on positive answers from other programmes, multiple applications cause a decrease in applicants especially with a view to the internationally competitive applicants. Therefore, approximately twice as many positive answers are given in the course of the procedure than the volume of the dependent variable of the age group of 25 students (fig. 3).

In many engineering and environmental science study programmes, the decision on the admission is taken solely or largely on the basis of the grade of the preceding qualification

phase, i.e. in the case of M. Sc. programmes based on the average grade of the bachelor degree. However, the objective of the selection procedure is not a reward for the previous study success but selecting the students having the best chance of succeeding in the M. Sc. Programme. Owing to internationally varying learning and evaluation cultures as well as the interdisciplinary character of the WATENV study programme it was deemed necessary to add further criteria for the sake of an objective and fair assessment of the expected success of the applicants. This includes a letter of motivation, the proof of a good command of English, optionally work experience in a similar field, special academic distinctions and letters of reference. On top of that, telephone interviews are conducted with applicants on the short list. The process follows the guidelines of the DAAD-AST-study programmes, complemented by a technical discussion to assess previous knowledge.

The experience made with the first three academic years has confirmed that the average grade of the bachelor degree is of limited value as a predictor for success after the first year. Figure 4 compares bachelor degree grades and the study success after two terms (sample size $n=44$ students), resulting in a correlation coefficient of $k=0.32$ for all students. Distinguishing between engineering (ING) and geo- and environmental (GUM) bachelor degrees, leads to a slight difference (ING (only): $k=0.30$ at $n=37$). There were striking differences between the grades of several students of African origin, with some women considerably improving their results and some men proving the contrary. Without African students, the correlation coefficient is 0,43 with $n=35$. Although the sample size is still relatively small, similar correlations are listed as in the meta studies by KUNCCEL et al. (2001) and TRAPMANN et al. (2007).

The studies were terminated in five cases not recorded in figure 4. These were mainly due to language problems. There is indeed evidence to suggest that regionally differing valuation and learning cultures and language skills are restricting the use of the bachelor grade as a predictor rather than prior knowledge in engineering science. The latter may be due to the interdisciplinary structure of WATENV as well as the adaptation modules. The so far small number does not yet allow any generalisation, does however confirm the importance of telephone interviews and of the approved language certificates from some countries where English is the official language.

Student support

The international master training is characterised by a high percentage of students coming from foreign countries to Germany for the first time. Correspondingly, the particularities of intercultural cooperation and the processes during the study are to be communicated again or for the first time. A timely entry into Germany and a good preparation are an asset in preventing problems at the onset of the studies. Therefore, extensive information and local support granted to those interested in the studies as well as to beginners is essential. This is true e.g. of language courses, cultural knowledge, the study procedure as well as the examination terms, but also place of study, support in finding accommodation, advice on arrival in Germany, collection at the airport, key delivery, visa matters, health insurance (appointment for groups), visit to authorities, student ticket and banking. In addition to the registrar's office of the WATENV

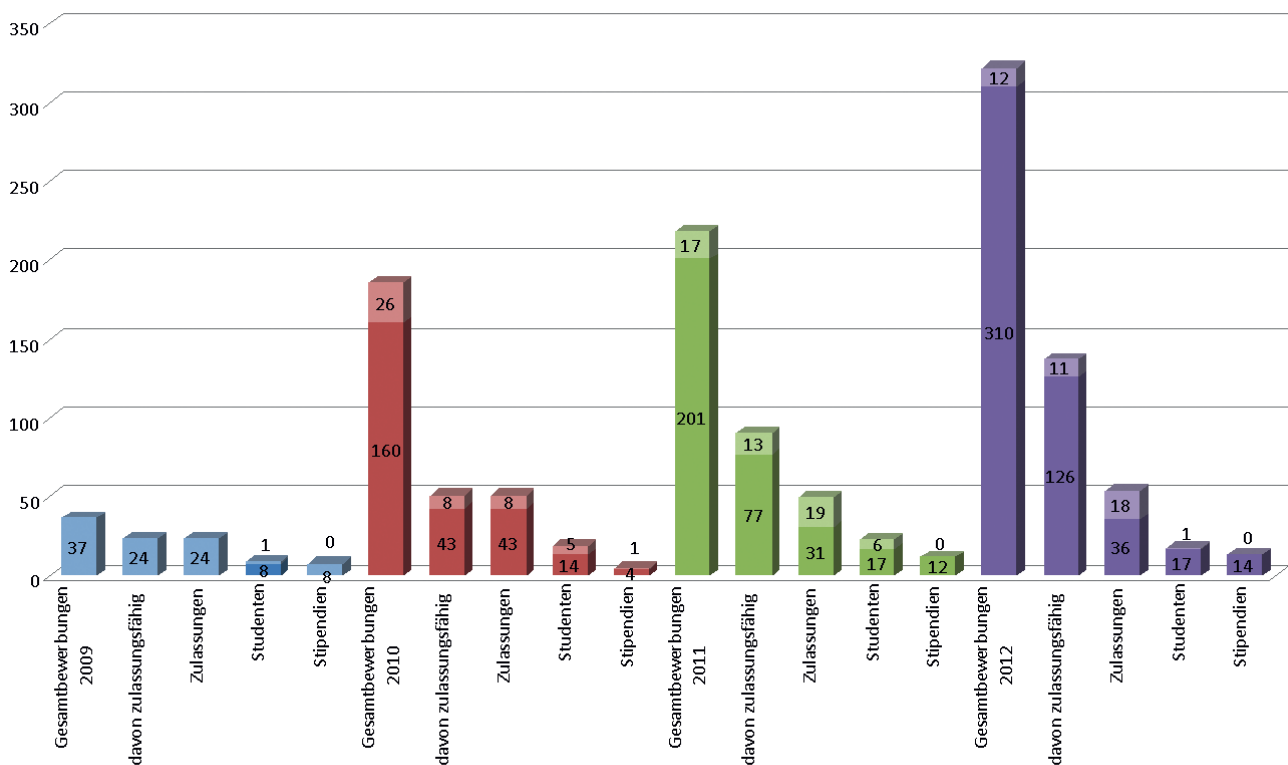


Figure 3

History of applications, admissions, students and scholarships for the WATENV programme in 2009 to 2012, showing persons from developed countries (upper part of the columns/light colours) and developing countries according to OECD (lower part/dark colours).

programme as well as student tutors, the student services, the technical languages centre as well as the "International Office" of the Leibniz Universität take an active part.

Prior to taking up their studies, the DAAD scholarship students attend a course in German lasting up to 4 months. Hence, these students had occasion to familiarize themselves with the German culture, everyday life, learning and working methods, to socialize and organise their environment to enable concentrating on the studies right from the first term. Students arriving later, are obliged to attend a course in German running parallel to the first two terms.

The students appreciated an intercultural weekend-workshop sponsored by the DAAD and first offered in 2012 starting prior to the beginning of the lectures as the entire age-group level was given the opportunity to get to know each other and learn much about the German culture and other cultures.

Interactions with study programmes for educational residents

By introducing WATENV, the curriculum was expanded by new modules taught in English only. Given that the number of teaching staff could not be substantially increased but had to be supplied largely from own sources, single courses resp. lectures (normally elective subjects with smaller classes) were offered in English for all study programmes. This allowed German-speaking students to take foreign-language classes, a fact that was generally accepted, but not by all. Although the lessons are mostly not

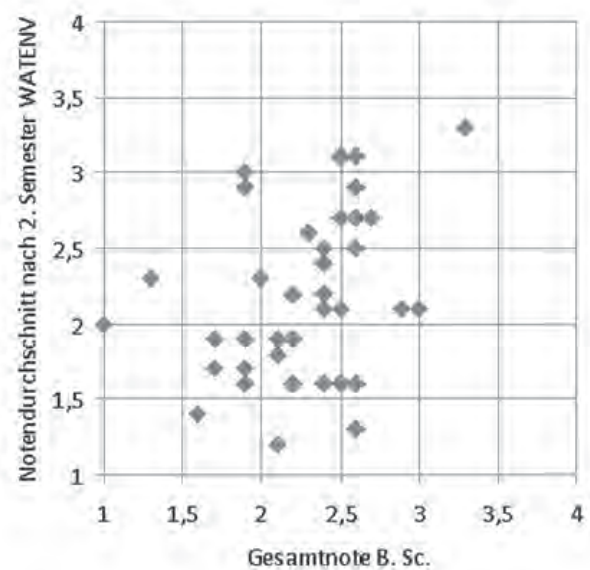


Figure 4

History of applications, admissions, students and scholarships for the WATENV programme in 2009 to 2012, showing persons from developed countries (upper part of the columns/light colours) and developing countries according to OECD (lower part/dark colours).

given by native speakers, they do allow learning the international technical vocabulary required for further academic qualification. Especially students aspiring a career in international cooperation have the opportunity to get to know an internationally and culturally highly heterogeneous group and to improve their own interculturality. The English-language course "Integrated Water Resources Management" including tutorial was attended by 18 WATENV students in the summer term 2012 and 14 students from German-language study programmes. Just one of the German students took advantage of the opportunity of writing his term paper in English. In the winter term 2012/2013, the course "Hydrological Modelling" was attended by 15 WATENV students and 21 students from various German study programmes. As two students had to share one computer in the pertaining tutorial, the group was partially mixed. However, a keen interest of one student group in the other group could not be observed. The German students in WATENV are much better interconnected with the international students than the German students of the national study programmes.

To date, German students have not been specifically recruited for the study programme WATENV. Up until now, there have been between one and three German students per year, all of them changing over from other locations to Hannover. According to statements made by other students, these were able to support their international classmates in their integration efforts. On the other hand, German students have the option of establishing international contacts e.g. with employers of other students and increase their mobility, e.g. by visits to developing countries. One of the German students, for instance, participated in the accreditation of an East-African master programme. Furthermore, German students are motivated and supported in doing an internship or writing a master thesis in a developing country. To this end, a cooperation for the exchange of students has been agreed with the university of Concepcion in Chile. Within the scope of this cooperation, three German students of various disciplines succeeded in completing an internship in Chile during the last two years. For the first time, a German WATENV student is writing her master thesis in Chile.

3 Summary and Conclusions

Expanding the curriculum of the faculty of civil engineering and geodesy by an international water-related study programme is a contribution to internationalising teaching at the Leibniz Universität Hannover. This comes in useful for German-speaking students wanting to increase their intercultural experience via the German-speaking study programmes or, as students of the international course, are wishing to build competencies in developing countries in the fields of hydrology/water resources management and sanitary engineering. A continued development of elective subjects is one of the key aspects of further developing the curriculum. One of the challenges in coordinating the study programmes is to permanently refine the admission procedure in order to prevent study terminations and maintain the quality of the study programme. To further improve the forecast of success of the studies, structured interviews were integrated into the admission procedure. The already complex support of students by administration and teaching staff was accompanied by expanding integration efforts in terms of

language and culture prior to the beginning of the studies. Further activities are planned for the future while the results are to be presented to the expert public.

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