
International Networking in Engineering Education

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Prof. Norbert Grünwald received his education in the former German Democratic Republic (GDR). During this time, there were only limited opportunities to acquire international experiences behind the so-called *Iron Curtain*. Nevertheless, he sought an international path even then. While studying mathematics at the University of Rostock, he studied for four months in Hungary. Later, the supervisors of his doctorate studies were from Hungary and Russia. After successfully completing his doctoral studies, Prof. Grünwald continued his scientific career at the Maritime University (Hochschule für Seefahrt) in Warnemünde/Wustrow. There he worked on scientific problems dealing with operations research and combinatorics, and taught mathematics for engineers. During this time, he worked closely with Prof. Harper from the University of Riverside, USA. After the reunification of Germany and the restructuring of the higher education system in former East Germany, he obtained a professorial position at Hochschule Wismar – University of Technology, Business & Design (HSW). First as a Professor, then later as Dean and now as Rector, he has placed special emphasis on education and research, as well as university development, based on international standards, collaboration and global networking.

INTRODUCTION

Beginning from his first year of schooling, it was easy for the author to study mathematics. So he went to special training courses and took part successfully in the German Mathematical Olympiad. As such, it was a clear-cut decision for him to pursue mathematics studies.

Apart from mathematics studies, he was also involved in the training and education of the next school generation in mathematics. So he passed on his knowledge and experience in problem-solving and mathematical methods in training courses at the regional and national levels. He was involved in the preparation of the former German Democratic Republic (GDR) teams for the International Mathematical Olympiad (IMO), and was also engaged in school teacher training and further education courses.

He continued this work after his successful doctoral studies in 1984 at the Hochschule für Seefahrt (Maritime University) in Warnemünde/Wustrow. While there, he was in charge of teaching mathematics to engineers. The main objective of his teaching was to incorporate (especially in engineering degree courses) more real problems, as well as practical and complex

tasks, in the teaching of mathematics, rather than academic exercises. This also involved non-standard argumentation, the connection of mathematical concepts with situations from everyday life and environment, as well as repeating and deepening understanding from earlier learned subjects and networking them. The author firmly believes that the power of mathematical thinking is the ability to create concepts and models, as well as the development of efficient processes and algorithms in order to solve concrete problems.

Consequently, he became quite committed for the yearly mathematical competition for engineering and economics students in the GDR and was in charge for the preparation of the team from Hochschule für Seefahrt. This competition sought to formulate real world tasks that students had to solve in classroom examination-like conditions. However, after 18 successful years, this competition did not survive the reunification of Germany due to various reasons. The last competition took place at Hochschule für Seefahrt in Wustrow 1989, with the author as the organiser.

In 1992, after the reunification of Germany and the restructuring of the higher education system in Eastern Germany, he obtained an academic position as Professor for Mathematics and Operation Research,

at the Faculty of Mechanical Engineering/Process and Environmental Engineering at Hochschule Wismar – University of Technology, Business & Design (HSW) in Wismar. The author continued his passion in educating elite pupils in mathematics. He was placed in charge of the task commission for the (all) German Mathematical Olympiad and he is a jury member of the German Mathematical Olympiad at the federal level.

Next to this elite promotion, the author is also keen on finding broader public recognition for mathematical problems. His strong belief is that the meaning of mathematics as a *culture technology*, as a basis for a rational, logical, complex and networked style of thinking, is equally great. Mathematics sharpens the eye for the essential (abstraction), the simple and the beautiful (art). Furthermore, it demands and supports persistence and perseverance (character).

Finally, mathematics, as a general structure science, reveals many questions that are of a philosophical dimension (eg continuity-discontinuity, infinity, the role of ideal objects in the recognition process, image character, etc). Its comprehension of a *scientific world view* is, therefore, imperative [1]. For this reason, children have begun to be educated in this direction as early as possible. Given this background, the author was delighted when an international group invited him to establish a so-called *Kangaroo Competition* in Europe, especially in Germany. This multiple-choice mathematical competition for students from 8 to 19 years of age focused on the popularisation of mathematics.

However, his main task was centred on mathematics in engineering education. It is well-known that crucial parts of engineering education are focused on mathematics, natural sciences and engineering foundations. Modern mathematics education has to be directed towards the following aspects:

- General or all-round education;
- Recognition;
- Understanding and life-long learning;
- The acquisition and learning of methods for solving problems;
- Especially in the modern mathematical education of engineering students, it has to be recognised that understanding and being able to handle the basics and foundations of mathematics is more important than knowing many details;
- The use and successful interpretation of results precedes being able to prove results;
- The control of computations, calculations and estimations is more significant than being able to carry out computations by oneself.

Of course, there is also the need to learn basic calculus techniques very well. However, mathematics has to be understood as a fundamental culture, and not as a collection of formulae and calculus instructions, as a development of ideas and not as a finished work, as an explanation of the origins of mathematical terms (mathematical and non-mathematical causes).

Students need to be taught to solve problems on their own, also with pressure, via performance requirements (tests, intermediate examinations), to integrate practical and complex tasks, but also to convey content, which is considered essential to the development of mathematical thinking (even if some students will not need this later on). This should include methods, problem solving and solution strategies. This has to be undertaken at schools, as well as at universities, by mutual agreement and cooperation [1].

HOCHSCHULE WISMAR-UICEE COLLABORATION

Germany is currently going through a difficult period in order to modernise and adjust its higher (engineering) education system to a much more global and flexible system, which would facilitate the exchange of information, participation in global affairs and, even more importantly, influence the global system of higher education. International cooperation, plus the exchange of ideas and experiences, is the most successful way to accomplish this.

The collaboration between Hochschule Wismar and the UNESCO International Centre for Engineering Education (UICEE) basically commenced at the first meeting between the author and then A/Prof. Z.J. Pudlowski when they both attended a UNESCO International Conference on Engineering Education, held in Moscow, Russia, in May 1995. This was the starting point for a successful collaboration, the generation of many ideas and the realisation of many projects.

The following research, development and scholarly activities in engineering education give an overview of the successful activities between the UICEE and Hochschule Wismar, especially through the friendly and innovative collaboration between Prof. Z.J. Pudlowski (UICEE Director) and the author.

In 1998, the author was elected the Dean of Mechanical Engineering/Process and Environmental Engineering, and in 2002 as the Rector of Hochschule Wismar. Since 2003, he was also appointed a Deputy Chairman of the UICEE Academic Advisory Committee (AAC).

RESEARCH, DEVELOPMENT AND SCHOLARLY ACTIVITIES IN ENGINEERING EDUCATION

International Conference *European Dimension in Education* (1996)

The International Conference on the *European Dimension in Education – Life Long Learning: an challenge for Universities and Enterprises*, was held at Hochschule Wismar from 9-11 May 1996. This was the first international conference after the reunification of Germany organised at the Faculty of Mechanical Engineering/Process and Environmental Engineering in Hochschule Wismar under the leadership of the author. This conference, supported by the European Union (EU) and the Ministry of Justice of Mecklenburg-Western Pommerania, brought together over 30 academics from higher education institutions in Europe to discuss further cooperative activities in life-long learning.

Reform of Mathematics and Computer Science Studies in Engineering at HSW

The reform of studies in mathematics and computer science in engineering at Hochschule Wismar took place between 1997 and 1999 [2]. The power of mathematical thinking is the ability to create concepts, models and the development of efficient processes and algorithms in order to solve concrete problems. Engineering students need to understand that this becomes a major part of their working as an engineer. The reform of studies in mathematics and computer science in the engineering curriculum at Hochschule Wismar follows the three steps, as follows:

- A thorough investigation and exploration of applications and experiences with the Society for Computational Economics (SCE) worldwide;
- The working out and testing of new content and methodology of education in mathematics and computer science using the SCE;
- The evaluation and reworking of concepts and changes to the existing curricula.

The objectives of this project are namely:

- To enable students to acquire the capacity for life-long learning, in part through a training of thinking that will provide graduates with the capacity, after decades of working, to be innovative in their professional area. To this end, lectures, exercises and seminars should not only constitute the

preparation for examinations, but they must also provide students with an extensive mathematical knowledge and understanding, a wide range of mathematical methods for their professional area, and the opportunity to recognise and to apply logical structures;

- To increase the attractiveness of the mathematics and computer science modules;
- To combine the different subjects of study – starting with mathematics and computer science – in order to expose students early on to realistic engineering problems. In other words, applying mathematical and computer science methods from the first to the last year of study;
- To integrate professionally-oriented exercises and project work methods;
- To operate more closely with scientific methods, solution-oriented methods and problem-solving techniques with the use of modern communication tools from the commencement of studies;
- To increase the independence of students through their acquisition of knowledge using learning software.

Cross-disciplinary cooperation in engineering using technical and scientific computing environments support traditional teaching methods with modern tools for problem solving. It does not undercut the standard of education or necessary subjects, but it is vital that the curriculum be carefully considered and that *teaching ballast* be rejected in favour of new methods [3][4].

The initial experiences show the following:

- The attractiveness of mathematics and computer science to engineering students is increasing;
- The acceptance of mathematics and computer science by engineering students has improved;
- Students better understand engineering teaching contents;
- Students display higher motivation for independent learning.

Students are also able to acquire the following general non-technical skills:

- Communications skills through the processing and presentation of project results in teams;
- Thinking in logical structures and principles of a systematic approach;
- Independent acquisition of knowledge by using learning software;
- Learning how to learn;
- Oral and written presentation techniques [5].

90th Anniversary Jubilee Seminar on Engineering Education (1998)

As one of the activities in celebration of the 90th anniversary of engineering education in Wismar, an extremely successful Seminar, entitled *90th Anniversary Jubilee Seminar on Engineering Education*, was carried out at the Hochschule Wismar between 6 and 9 May 1998 in cooperation with the UICEE.

The paramount objective of this important meeting was to set up a *German Network for Engineering Education* to operate in collaboration with the UICEE. The Seminar was attended by 80 delegates from 15 countries, and close to 40 paper presentations were made. A special issue of the UICEE's *Global Journal of Engineering Education* (GJEE), presenting selected papers, was published in August 1998 in commemoration of this event.

During the Seminar, four UICEE Silver Badges of Honour were awarded to academics in recognition of their outstanding contributions to engineering education. Two in particular were given to academics of the host institution. The recipients were: Prof. Burckhard Simmen, HSW Rector and Seminar Patron; and to the author, then Vice-Dean of the Faculty of Mechanical/Process and Environmental Engineering, and the Seminar General Chairman.

2nd Global Congress on Engineering Education (2000)

After the very successful joint international Seminar between the UICEE and Hochschule Wismar in May 1998, the HSW was proud and honoured to have the chance to run the *2nd Global Congress on Engineering Education* from 2 to 7 July 2000 in Wismar. The Congress was organised in cooperation with the UICEE. The author was responsible for the local organisation team and the Congress was attended by about 150 delegates from over 30 countries and all continents [6].

In the framework of the *2nd Global Congress on Engineering Education* was also organised a *German Day* on 7 July 2000, and as a special session of this day, a meeting of the German Network on Engineering Education. This meeting was attended by 16 representatives from seven German universities and international guests, among them the editors of two international journals (Prof. Z.J. Pudlowski from the *Global Journal of Engineering Education* and Prof. M. Wald of the *International Journal of Engineering Education*).

In a *brainstorming* session, the participants discussed the situation and possible developments in

German engineering education. The resulting problems, potentials and ideas were topics of an annual *German Seminar on Engineering Education* series, starting in 2001 in Mannheim, followed in 2002 in Wismar.

During the Seminar, a UICEE Gold Badge of Honour was awarded to the author in recognition of his outstanding contributions to engineering education.

Establishment of an Annual German Issue of the Global Journal of Engineering Education (2000)

Another result of the *2nd Global Congress on Engineering Education* in Wismar was the establishment of an annual issue of the UICEE's *Global Journal of Engineering Education* in the German language, with the first issue being Vol.4, No.2.

Up to now, there have been six issues published, all with Prof. Grünwald as Guest Editor.

Launch of the Gottlob Frege Centre for Engineering Science and Design (GFC) (2000)

Gottlob Frege was born on 8 November 1848 in the North German Hanseatic town of Wismar on the Baltic Sea coast. He also attended the school there. Frege was a mathematician and philosopher, having studied in the German towns of Jena and Göttingen, and having taught most of the time as a professor in the Mathematics Faculty in Jena. Frege died on 26 July 1925 in Bad Kleinen, located near Wismar.

The Gottlob Frege Centre (GFC) for Applied Mathematics was founded in November 2000 by a group of 12 professors from mathematics, computer science and physics at Hochschule Wismar on the occasion of the 152nd birthday of Gottlob Frege, the German mathematician. The Centre intends to rekindle an appreciation of Frege's work and, by the same token, increase public awareness of the importance of basic training in mathematics for future development. The Co-Directors of the Gottlob Frege Centre are Prof. Dieter Schott and the author [7][8].

In 2001, Hochschule Wismar and the UICEE signed a Memorandum of Understanding on partnership and established a UICEE satellite centre named the *Gottlob Frege Centre for Engineering Science and Design* (GFC) based at the HSW. As a so-called satellite centre of the UICEE, the Centre seeks to develop into a *nodal point* of a worldwide forum for the discussion and organisation of *modern* and *demanding fundamental mathematical training* for engineers and economic specialists. The development

of computer technology and new media opens various new methods to impart basic theoretical knowledge to students [9].

Those involved with the GFC are confident that the HSW's partnership with the UICEE and its integration into the network of UICEE partners is the best guarantor to reach the objectives of the GFC. The network of institutions of the UICEE family currently includes over a dozen Partner institutions, plus various Supporter and Contributor member institutions from around the world.

The GFC is a relatively independent organisation at the HSW, which coordinates the *basic science education* for:

- *Strengthening*: ensuring the scientific foundations of practice-orientated training.
- *Bringing up-to-date*: considering modern societal and technological developments and their consequences for an efficient, advanced and motivating training.
- *Making international and global*: using international experiences and working towards a global standard.
- *Making attractive*: convincing students and the public of the importance and beauty of the basic sciences.

The GFC also cooperates within the HSW and, moreover, with all regional, national and international partners that are directly or indirectly involved or interested in forming and realising basic science education in engineering.

The Centre also seeks to establish a network that integrates the University with schools and industrial partners. This network should be used to improve basic science education. It is necessary to communicate with schools, industry and the public to determine the present strengths and weaknesses in basic science education, starting with schools and continuing to the University.

Partnership with the UICEE

With the signing of a Memorandum of Agreement (MoA) on partnership with the UICEE in 2001, after six years of close cooperation, Hochschule Wismar acquired the status of a Partner institution within the burgeoning network of the UICEE. This has facilitated the HSW's access to the UICEE global network, opening up possibilities for wide mutual cooperation within the global network of UICEE organisations in research and software development in engineering education, training programmes, the

exchange of academic materials and scholars, cooperative conferences, seminars and meetings, as well as joint publications.

Project on International Quality Networks

From July 2000 to December 2004, the German Academic Exchange Service (DAAD) supported the project called International Quality Networks (IQN). The call for applications of this project coincided with the formation of the GFC and the partnership of Hochschule Wismar with the UICEE. These milestone events parallel the goals of this project, namely the integration and active collaboration of the HSW in the international network of the UICEE, as well as establishing the GFC, as a satellite centre of the UICEE, as a competence centre of application-oriented science education in the tertiary sector. The project was led by the author and the GFC. Indeed, it was considered that the successful application was the recognition of the HSW's international engagement. The funds were utilised to invite lecturers, researchers and students of partner institutions to Wismar [10].

Altogether, the HSW hosted over 80 academics and over 60 students, mostly for one semester, from countries near and far, including Australia, New Zealand, Canada, Norway, Sweden, England, Scotland, Poland, Russia, Latvia, Taiwan and Rwanda. Over 30 joint papers have been published. Many conferences have been organised with partners, including the above mentioned *2nd Global Congress on Engineering Education*, held in early July 2000, and the *6th Baltic Region Seminar on Engineering Education*, conducted in late September 2002, both of which were jointly organised with the UICEE. The HSW has integrated guests into its aims and tasks to achieve international support and gain allies for its educational goals and ambitions [11].

International Study Partnership Programmes (ISAP) (2000-2005)

The International Study Partnership Programmes (ISAP) have been supported by the German Academic Exchange Service (DAAD) from 2000-2005. Following the *2nd UICEE Annual Conference on Engineering Education*, which was held in February 1999 in Auckland, New Zealand, a Memorandum of Understanding was signed between the engineering faculties at Auckland University of Technology (AUT) and Hochschule Wismar. This Agreement, initiated by Prof. Roy Geddes from the AUT and the author, was initially planned to facilitate student exchange. But this soon expanded, with professors from both institutions

visiting and giving lectures at the other institution.

2005 was the fifth year that engineering students from Germany, New Zealand and Australia took part in an international benchmarking programme. The course, entitled *Engineering Ethics* and taught by Prof. John Buckeridge then from the AUT, looks at the special role that engineers can be expected to take in society. It has been run in all three countries as a short but intense seminar held over one week, where students are challenged to solve engineering problems from an ethical perspective. Importantly, students from each country study the same questions [12].

Overall, this has proved to be one of the most successful efforts in cooperation for the HSW, resulting in 14 joint research papers, two joint book projects and the exchange of over 30 students in both directions. The yearly exchange of two staff members in both directions for up to one year helps to document the high quality of collaboration [13].

6th Baltic Region Seminar on Engineering Education (2002)

The highly successful 6th *Baltic Region Seminar on Engineering Education* of the UICEE was held in 2002 at Hochschule Wismar from 23-25 September 2002. The Seminar focused on maritime engineering education, its impact and future for the Baltic region and the world. Prof. Grünwald was in charge of the local organisation. There were more than 80 participants from 20 countries. Among the activities of the Seminar were the visits to the Warnemünde Marine Simulation Centre and the tallship *Dar Młodzieży* of the Gdynia Maritime University (GMU), Gdynia, Poland, which visited Wismar on this occasion.

The Seminar was held during the time of celebrating the 10th anniversary of the reestablishment of Hochschule Wismar and in conjunction with the 2nd *German Seminar on Engineering Education*. HSW provided the venue and organisational support for the German Seminar. The GFC also organised the 2nd *Workshop on Mathematics for Engineers* during this time. The participants discussed mainly problems of integrating modern media in the basic education of engineering students.

Learning Regions (EGOS) (2001-2006)

Learning Regions (EGOS) has been supported by the German Ministry of Education and Research (BMBF) for 2001-2006. The goal of this project is to strengthen the economic power of the EGOS-region (Westmecklenburg, the region around the triangle Rostock, Schwerin and Wismar) through technical,

mathematical and natural science education. The author has led the overall project and the GFC is in charge for the sub-project with the topic of *strengthening and bringing up-to-date the mathematical education* in the region, including schools, vocational schools and universities. Teachers, pupils and students from primary school to university are integrated in the project, preparing teaching and learning material with a special focus on e-learning. The integrative work is realised through meetings and workshops.

Additionally, two attractive books with the titles, *Money Puzzles* and *Science Puzzle* (with *Shape Puzzle* is in preparation) have been published. These have been written by Prof. Klymchuk, a colleague from New Zealand, with the author acting as the translator into German and the contents revised by members of the GFC. The book shows the importance of elementary mathematics in daily life, and supports critical thinking and financial literacy [9].

Another goal has been the development of online courses for study beginners. This course began with material from elementary mathematics to support those study beginners who have some mathematical deficiencies. The course will be further extended to important advanced subjects. The material complements classical teaching tools. *WebCT* is being utilised as an e-learning platform. Here, HSW also profits from the experiences of its national and international partners in this field. Pupils, students and guest students help to install the material into the net. Additionally, the HSW has established a special e-learning group at Hochschule Wismar that organises lectures and colloquia. Cooperation with German university partners in the field of mathematical training (Rostock, Hamburg, Nordrhein-Westfalen) also concentrates on exchanging experiences and materials prepared for the Internet [14][15].

Launch of the UICEE European Headquarters (UICEE-EHQ)

Against this background, the UICEE and the HSW decided to enter a new stage of relationship and cooperation. An Agreement between Hochschule Wismar and the UICEE on the establishment of the European Headquarters of the UICEE at Hochschule Wismar was signed on 3 September 2004 in Kaunas, Lithuania, on the occasion of the 8th *Baltic Region Seminar on Engineering Education*, organised there by the UICEE [16].

The main objective of this action has been the expansion of the UICEE's presence in Europe in the form of a parallel office of the UICEE. It is hoped that this will also strengthen the UICEE's operation in

Europe, and would take forward the mission, aims and objectives of the UICEE on the European scene. Another important objective of this action is to promote the HSW globally and, in particular, through the extensive network of the UICEE members in Europe [17].

It was formulated in Article 1 that the purpose of this Agreement is to further expand the relationship already established between the UICEE and the HSW through the establishment and development of the *UICEE European Headquarters* (UICEE-EHQ), taking into account the fact that Hochschule Wismar is a European academic establishment and is an international leader in the development of higher education, with close to 100 years of academic achievements, so that the HSW is well suited to host the UICEE-EHQ.

It was formulated and decided in Article 2 that the UICEE-EHQ would provide the focus for the development of academic and research related activities in engineering education with particular emphasis on the European scene, in order to further the globalisation of engineering education and, in particular, to provide assistance to institutions in Central and Eastern Europe.

It was agreed upon in Article 3 that the UICEE-EHQ would collaborate strongly with the GFC, but that the GFC would continue to operate as a separate entity.

The scope of the UICEE-EHQ was defined and formulated in Article 4 to be as follows:

- To provide strong leadership for the European section of the *UICEE Global Network of Engineering Education*;
- To strengthen the position of the already established GFC at the HSW;
- To establish a wide range of activities to reflect the mission, aims and objectives of the UICEE relevant to the European context, taking into account the aims and objectives of the HSW;
- To apply for grants from funding agencies in Europe in order to undertake projects considered critical for the European scene, with particular emphasis on providing assistance to institutions in Central and Eastern Europe;
- To undertake a leading role and facilitate progress in engineering education R&D in the Baltic Region;
- To facilitate the exchange of scholars, as appropriate, in order to take forward academic and research related activities in engineering education;

- To transfer some of the activities from the UICEE to the UICEE-EHQ, such as the German issues of the *Global Journal of Engineering Education* (GJEE), other specific publications, research and development programmes, etc;
- To organise seminars, workshops, conferences and other academic meetings in Europe, as appropriate, in collaboration with other organisations involved in engineering education;
- To support the production of publications, books and software in engineering education;
- To disseminate information on engineering education throughout Europe, and to transfer such information to developing countries worldwide [18].

To implement the aims and purposes expressed in the articles above, certain specific actions were mutually discussed, understood and agreed upon as follows:

- Proposals for the development and operation of the UICEE-EHQ would be submitted to the host organisation;
- The UICEE and its EHQ would have only one Academic Advisory Committee, which is the existing Committee;
- Individual programmes of research and other activities would be developed in accordance with the human and financial resources available;
- The final approval of any project is dependent upon the availability of guaranteed support funding.

Relevant publications of the UICEE would present the HSW as the seat of the UICEE in the same manner as for Monash University in Melbourne.

Membership

Relevant memberships of the author in scientific organisations are as follows:

- German Mathematical Society (Deutsche Mathematiker-Vereinigung e.V, DMV) (member since 1991);
- UNESCO International Centre of Engineering Education (UICEE) (member since 1997);
- Deputy Chairman of the UICEE Academic Advisory Committee (since 2003);
- International Liaison Group for Engineering Education (ILGEE) (member since 1997);
- Mathematikolympiaden e.V. (member since 1995) – Chair of the Task Committee and Jury (federal level);

- Akkreditierungskommission für Studiengänge der Ingenieurwissenschaften, Informatik und Naturwissenschaften, (ASSIN – accreditation agency that specialises in accrediting degree programmes from the fields of engineering, informatics/computer science, the natural sciences and mathematics) (member since 1999);
- Member of Accreditation Commission and Technical Commission 1 (Mechanical Engineering/Process Engineering);
- *Kangourou san Frontiers* (member 1992-2003);
- Co-Director, *Gottlob-Frege Centre for Engineering Science and Design*, a UICEE satellite centre, Hochschule Wismar (since 2000);
- Associate Editor, *Global Journal of Engineering Education*, Melbourne, UICEE, Australia (since 1999);
- Associate Editor, *World Transactions on Engineering and Technology Education*, Melbourne, UICEE, Australia (since 2002);
- Publication Committee, *International Journal of Technology and Engineering Education*, National Changhua University of Education, Taiwan (since 2004);
- Technisches Landesmuseum Mecklenburg-Vorpommern (Technical State Museum) (Board member since 2003);
- Technologie- und Gewerbezentrum e.V. Schwerin/Wismar;
- Technology and Commercial Centre (TGZ) (Board member since 2004);
- Nordmetall-Stiftung (Foundation of Metal and Electro-Industry Employers) (member of Board of Trustees since 2003);
- Ingenieur- und Wirtschaftsakademie *Johann Beckmann* e.V. (member of Board of Trustees since 2004).

SUMMARY AND CONCLUSIONS

The increased level of globalisation has generated new and exciting opportunities for international linkages and collaboration. Both the UICEE and the HSW have taken advantage of this global trend and established mutual relationships and joint activities for the benefit of the two parties involved, as well as the entire global community of engineering and technology education. The advantages and benefits coming from this relationship for the UICEE may be characterised by the increased number of joint activities, such as conferences and meetings, projects, publications, etc, whereas the HSW has the opportunity to realise its paramount objective to become a global university through the development of strong international

linkages and relationships, taking advantage of the UICEE global network of academic institutions, and being able to promote its achievements through the UICEE media provided to UICEE members. This has included collaborative research into diverse areas such as entrepreneurship and increasing female participation in engineering [19][20].

The collaboration between Hochschule Wismar and the UICEE basically commenced at the first meeting between the author and Prof. Z.J. Pudlowski, when they both attended a UNESCO International Conference on Engineering Education, held in Moscow, Russia, in May 1995 [2].

The history of contacts and the subsequent specific activities carried out by the HSW in accordance with the mission and objectives of the UICEE, and in close collaboration with members of the UICEE, are as follows:

- 1995: First contact with the UICEE established at the *UNESCO International Conference on Engineering Education* (Moscow, Russia, 23-25 May 1995);
- 1998: Hochschule Wismar becomes a *Supporter Member* of the UICEE;
- 1998: Joint organisation of the *90th Anniversary Jubilee Seminar on Engineering Education* at Hochschule Wismar (Wismar, 6-9 May 1998);
- 2000: Joint organisation of the *2nd Global Congress on Engineering Education* at Hochschule Wismar (Wismar, 2-7 July 2000);
- 2000: Launch of one annual issue of the *Global Journal of Engineering Education* – German Network in Engineering Education, published entirely in the German language;
- 2000: Establishment of the *Gottlob Frege Centre* (GFC) at Hochschule Wismar (8 November 2000);
- 2000: Successful launch of the DAAD programme titled *Internationale Studien- und Ausbildungspartnerschaft* with Auckland University of Technology (AUT), a Supporter member of the UICEE;
- 2001: Hochschule Wismar becomes a Partner institutional member of the UICEE, with the Gottlob Frege Centre becoming a satellite centre of the UICEE named as the *Gottlob Frege Centre for Engineering Science and Design*, with the author and Prof. Dieter Schott both appointed as Co-Directors of the Centre (6 June 2001);
- 2001: Successful launch of the DAAD programme entitled *Internationale Qualitäts Netzwerke* (IQN), developed in collaboration with 11 universities, mainly members of the UICEE network;

- 2001: Establishment by the GFC of an annual/bi-annual workshop called *Mathematics in Engineering Education*;
- 2002: Joint organisation of the 6th *Baltic Region Seminar on Engineering Education* at Hochschule Wismar (23-25 September 2002);
- 2002: Successful launch of the EGOS project, a BMBF programme named *Lernende Region*, in collaboration with some international partners drawn from the UICEE network;
- 2003: Prof. N. Grünwald becomes a Deputy Chairman of the UICEE Academic Advisory Committee (5 March 2003);
- 2004: Launch of an EU project called *Masters in Problem-Based Learning*, jointly with three UICEE Partner Institutions, namely: Aalborg University (Leader), Aalborg, Denmark; Glasgow Caledonian University, Glasgow, Scotland, UK; and *Lucian Blaga* University of Sibiu, Sibiu, Romania, all three institutions being Partner members of the UICEE;
- 2004: Launch of a DAAD-DST (India) Research Project with Anna University, Chennai, India, then a Partner member of the UICEE;
- 2004: Signing of an Agreement with the UICEE on establishing the UICEE European Headquarter (UICEE-EHQ) at Hochschule Wismar (Kaunas, Lithuania, 3 September 2004);
- 2004: Official Launch of the UICEE-EHQ in Wismar (9 September 2004).

Also, several activities and concrete actions have been undertaken in recent years, as follows:

- 2000-2001: Three students from Germany visited the UICEE in Melbourne (recommended by Prof. N. Grünwald), with each of them spending one semester as an occupational trainee;
- 2000-2004: Numerous undergraduate students and academic staff have visited the HSW under the International Quality Network (IQN) established at the HSW; these included some students from the Higher Education Professional School, Tarnów, Poland, who carried out their practice abroad and completed their final year projects under the supervision of academics from the HSW [6];
- The author has also served as a peer referee of conference papers and journal articles published by the UICEE, member of programme committees, session chairman, etc, in relation to UICEE-conducted activities;
- The author has published over 50 publications in the field of mathematics and engineering education (more than 30 mutually with international partners), with most having been generated in collaboration with academics drawn from the UICEE network.

The author strongly believes in promoting engineering education, and in capitalising on the advantages and benefits that arise from international linkages in engineering education, in forming and working in international networks, and hence seeks to facilitate such linkages.

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BIOGRAPHY



Norbert Grünwald was born in Rostock, Germany, on 5 October 1953. He studied mathematics at the University of Rostock, receiving the degree of Bachelor of Mathematics in 1979, and was awarded a doctorate, specialising in discrete mathematics, in 1984. Between 1984 and

1986, he was on the scientific staff of Deutsche Seereederei Rostock, a shipping line, before working as a scientific assistant in the Institute of Mathematics of the Warnemünde/Wustrow Maritime Academy.

In 1991, he took up a scientific assistant position in the Department of Mathematics of the University of Rostock, and since 1992, he has been Professor of Mathematics and Operations Research in the Department of Mechanical Engineering at Hochschule Wismar - University of Technology, Business and Design, Wismar, Germany, where he is actively involved in the self-government of the institution. From 1998 until 2002, he was the Dean of Mechanical Engineering/Process and Environmental Engineering and was elected Rector of Hochschule Wismar in September 2002.

Professor Dr Grünwald has published several works, various conference papers and journal articles, as well as has becoming involved in a number of research projects and expert reports. He is a coordinator and jury member of the German Mathematical Olympiad, and is a member of Deutscher Mathematiker-Vereinigung e.V. and Mathematikolympiaden e.V. Prof. Grünwald is also a member of the Accreditation Commission of the Accreditation Agency for Study Courses in Engineering, Informatics and Natural Sciences (ASIIN).

On the international front, he is a member of the International Liaison Group for Engineering Education (ILG-EE), and of the UICEE Academic Advisory Committee, of which he is a Deputy Chairman. He is also a Co-Director of the *Gottlob Frege Centre for Engineering Science and Design*, a satellite centre of the UICEE.

He was awarded the UICEE Silver Badge of Honour for distinguished contributions to engineering education in 1998, and the UICEE Gold Badge of Honour was conferred upon him during the *2nd Global Congress on Engineering Education*, held in Wismar in 2000.

Computer Applications in Engineering Education provides a forum for publishing peer-reviewed timely information on the innovative uses of computers, Internet, and software tools in engineering education. Besides new courses and software tools, the CAE journal covers areas that support the integration of technology-based modules in the engineering curriculum and promotes discussion of the assessment and dissemination issues associated with these new implementation methods.Â

- New software tools and multimedia modules for engineering education.
- Development and implementation experiences of Internet and web-based courses.
- New software tools for virtual and real laboratory development.

Educational networks of varying size and kinds have been established at the regional, national and international levels, and can be horizontal or vertical in nature.Â

1.3. networking for educational innovation: a comparative analysis.

A definition of networks in education emerging on the basis of discussions during the OECD Lisbon seminar (see Chapter 10) also indicates that networks in education are multifunctional: they are purposeful social entities that may enjoy a commitment to quality, rigour, and a focus on outcomes. They can also be an effective means of supporting innovation in times of change. The T.I.M.E. Association (Top International Managers in Engineering) is a network of leading technical universities and engineering schools founded in 1989. The members have a strong international dimension in their research, teaching and industrial relations, and are all committed to international cooperation and student exchanges and recognition of studies abroad. The association consists of 57 members in 21 countries. This is our mission.Â

The T.I.M.E. Association work primarily with the enabling of double degree studies in engineering, educational projects funded by the association, specialised task forces and networking for EU-funded projects in education. Read more about current activities. Latest news.