Application for the 2024 Minerva Informatics Equality Award

The International Women's Degree Program in Computer Science (IFI), Hochschule Bremen, University of Applied Sciences, Germany

Submitted by:

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https://www.hs-bremen.de/en/study/degree-programme/international-womens-degree-programme-in-computer-science-bsc/

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https://www.hs-bremen.de/en/hsb/organisation/university-management/

Abstract:

The International Women´s Degree Program in Computer Science (IFI) at Hochschule Bremen, University of Applied Sciences, Germany, has been working for nearly 25 years on the recruitment and successful retainment of young women in a single-sex bachelor´s study program in computer science. Since 2016 the study program has been complemented by a dual study offer. IFI´s long-term impact was recently analysed in a retention study based on the experiences of IFI graduates from the graduation years 2005 to 2017 and from their most important employers. The retention study confirms the concept of the IFI program convincingly.

Description of the IFI / IFI-dual program

Since the year 2000 the International Women´s Degree Program in Computer Science (IFI) has been working on the recruitment and successful retainment of young women in a bachelor´s study program in computer science. The program is strictly single-sex during the first 3 semesters. The program emphasizes an interactive teaching approach and offers best individual support by professors, tutors and IT experts from companies. In more detail the study program is organized as follows:

Curriculum

The curriculum corresponds to the standard education in applied computer science as recommended by the German Informatics Society. This includes standard topics (like programming, operating systems, databases, software engineering, human computer interaction, networks) as well as project work in a variety of application areas. Electives (like data science, robotics, testing, linux academy) provide the opportunity to define an individual focus. Only very few (female) students know the hardware of their own computers or are curious about it. Nevertheless, this knowledge raises confidence in one´s personal technical competences. Therefore, an explicit module on hardware is added during the first term where students learn to add and to remove hardware components, to install a new operating system and to configure their own network. This class ends with an installation party to get running all the software needed during the first year. This module is quite trivial for some students, but there is a significant number of students who need this class to become comfortable with all aspects of their own technical equipment.
Our students will be exposed as female IT experts in profession and in their private life. They like to have a broader perspective on IT, and the program supports this ambition. The curriculum includes a class on the implications of IT on society, where we invite experts for current topics and encourage discussions and the personal reflected positioning.

Teaching

In Germany the ratio of female computer science students varies between 10% (in technical computer science programs) and 20% (in business informatics or media informatics). So ,in any computer science class the female students build a minority. Minorities (anywhere) are subject to unspoken (and unintended) restrictive rules for participation. Especially female students have a lower technical self-esteem and tend to retain their contributions in a mixed class. Therefore, all classes during the first three terms are strictly single-sex. Per year 36 students are accepted to the IFI program. All teaching people know all students with their names – and all students are addressed personally in class with questions and direct invitations to present solutions or other contributions to the problems discussed. The program emphasizes that no prior knowledge in computer science is required. In this setting no one can compromise herself as being "the girl who doesn´t know".
In the labs the class is split into two groups to guarantee best individual progress in the concrete work with software or hardware. All classes and labs are supported by student tutors. The grading is based on continuous exercises during the teaching weeks and on final exams.

Students and professors

Universities of Applied Sciences like Hochschule Bremen usually attract students from the local area (Bremen and around). Typical students are the first academics in their family who prefer to live at home during their first years and who only gradually leave their well-known surroundings.
In contrast the IFI program attracts students from all over Germany and abroad: Constantly IFI is one of the study programs at Hochschule Bremen with the highest rate of students with a migrant background (about 30%). The IFI students build a very diverse group according to age, social status, family situation and cultural background.

Professors and teaching staff for the IFI program are selected according to the standard procedure at German Universities thus ensuring the same level of academic qualification. During the application procedure a special emphasis on the applicant´s interest and engagement in teaching is taken.

International exchange

The IFI program is an international one with a mandatory term spent abroad in the third year. Hochschule Bremen as well as the Department of Electrical Engineering and Computer Science and the IFI program hold more than 360 international cooperations with partner institutions (all over Europe, in Jordan, in India, in the US and Canada). The exchange is financially supported by European funding (Erasmus) that compensates for necessary extra expenses. The students get help in organisational issues from our International Office caring for housing and funding. The professors help with the selection of classes to be taken abroad. This agreement is fixed in a learning agreement of all parties (student – home university – partner university). In exchange students from abroad join the higher IFI classes. As well professors from partner universities contribute to electives.

The international exchange is depicted to be important for most IFI students who appreciate to gain international experience in this comfortable setting.

Dual program option

Since 2016 the IFI program has been complemented by a dual program option. In the dual program option students are not only students of Hochschule Bremen, but as well they are employees of partner companies and institutions. Right from the start they receive a basic salary. They are introduced to their partner institution through a series of internships where they work in regular teams and contribute by what they have learned so far at the Hochschule. Thus, they directly experience the use and practical application of their knowledge. Vice versa they contribute with their practical experience to the classes and labs of the forthcoming semesters.

Partner institutions are involved in teaching in the IFI program. They may offer topics for joint projects at the Hochschule. Our dual students write their bachelor´s thesis in cooperation between the academic and the practical world. After successful graduation the students are offered a permanent employment.

In the dual program the partner companies get to know their future IT experts right from the start. By cooperating with IFI-dual the companies can be confident of the diversity in their IT teams.

Soft factors

The program pays serious attention to several soft factors for students´ success:
Students from the same year get to know each other really well through interactive teaching and learning and through teamwork. Students from different years get to know each other through tutors and support in the labs by elder students. Homecoming students from their term abroad offer an international fair where they present the experiences made (on the foreign university, on computer science there, on food and music and friends …) to the outgoings of the next year.
A number of get-together-meetings (like the Christmas party for all students and professors, a summer barbecue at the end of the term) help to develop a more casual and relaxed communication style. Alumni are invited to these events as well. They provide information and experiences about their way so far and they can open the doors to future internships or employments.

Summary

All these components help to attract young women to a high-level education in IT and to retain them with a solid career option.

The IFI program´s impact

Single-sex study programs are definitely unusual in Germany. IFI as a single-sex study program in computer science always has to fight the prejudice to offer an unrealistic and too easy-going entrance to IT. Therefore, the program pays significant attention to high-quality standards in education and to the evidence of the program´s impact on female success in IT.

The IFI program was established in the year 2000 as a model project funded by the German government, Ministry of Education, and the free and hanseatic city of Bremen. The aim in setting up IFI was as follows: A practice-oriented IT degree program was to be established in Bremen, which would not so much pursue an academic qualification, but would primarily qualify students for the dynamic IT labour market. The program should appeal to young women and encourage them to take advantage of this educational and employment opportunity. During the first five years the program was continuously supervised and evaluated. In 2005 the first generation of IFI students had successfully graduated and positioned themselves in IT companies or in a continuing academic career. In answer to the impact proved so far, the IFI program turned to a permanent regular study program as part of the Department of Electrical Engineering and Computer Science at Hochschule Bremen.

The IFI program has now been in existence for almost 25 years. Time and opportunity to check the program´s sustainable success with a retention study! In particular, it is possible to track the career development of the IFI graduates over many years, to identify success factors during the studies and at the workplace and to clarify what makes young women stay and succeed in IT. The retention study addresses the following questions and relates the results to the corresponding data on coeducationally qualified female IT experts (according to the Germany-wide panel of the DZHW).

- Are the IT skills the IFI students acquire during their studies suitable for the labour market? And what about the social skills - can the young women from the mono-educational degree program hold their own in the male-dominated IT profession?
- What career paths do IFI graduates choose? How do they assess their professional status and experience? What do they see as helpful in their professional careers and what do they see as a hindrance?
- And vice versa: How do employers view their IFI employees - professionally and socially? Are there qualifications of IFI graduates that are particularly valued or particularly missed by employers?

The retention study was conducted by the Competence Centre Technology - Diversity - Equal Opportunities, Bielefeld. The addresses of about 100 female graduates from the 2005 to 2017 graduation years were available as input material, 64 of whom took part in the study.

The main results of the retention study are as follows:

- 80% of IFI graduates rate their identification with computer science as good to very good. In retrospect, IFI graduates are particularly positive about their study situation, the project and team orientation and the support by lecturers, tutors and the study group. "It was simply great to be welcome to ask any kind of question!" They highlight the effect of not blaming oneself because of missing prior knowledge or because of a little doubtful begin with the first

practical exercises. They emphasise the team spirit within the degree program, which has helped them personally to succeed and to establish a healthy technical self-confidence for their future careers.

- Employers unanimously welcome the increased diversity in their teams due to more female professionals. The employers surveyed primarily value meta-virtues such as tenacity, dialogue skills and team orientation. Whether or not a qualification has been obtained in a single-sex setting is of no importance for them.

- IFI graduates achieve a higher level of satisfaction in key aspects of their professional lives (compared to female IT experts from coed study programs): They are able to contribute their own ideas to a greater extent at the workplace. They work in an environment that responds to their changing work-life balance needs over the years of their working lives. This gives them a sense of belonging to the IT industry, which is proven by their long-term retention in their IT job.
  The retention study can´t identify the reason for this difference: Are IFI graduates smarter in the selection of their employer? Or does their solid technical self esteem empower them to fight for more satisfying working conditions?
  Anyway, IFI graduates know the widespread kind of mansplaining at the workplace, where male collegues tend to explain easy and well-known content to them, preferably in the presence of others. This phenomenon is simply reported by graduates of different years. The graduates find their own way how to deal with this behavior; some of them would have liked a preparation for situations like these during their studies.

IFI organised the conference "Women in IT - Sustainable Success Factors for Studies and Career" in May24 to present the results of the retention study to the public. The event was characterised by presentations and exciting discussions between representatives from universities, industry, university development planning, the German women's study programs and education research. All participants in the study (graduates and employers) and all those who have supported the IFI program over the past 25 years were invited. The IFI graduates mainly work in companies in the IT industry, aerospace technology or the financial sector in software development. Two graduates have successfully taken the step into self-employment and now run their own (small) companies. Several younger graduates are doing their doctorates. One graduate holds a professorship at the University of Oldenburg. Numerous graduates now live abroad and have participated via video messages (from the US, Australia and Canada, from London, Tunis and Nairobi). All these IFI graduates are convincing professionals who have achieved their positions with competence, commitment and the will to shape the future and who have a strong charismatic presence in IT.

IFI`s impact: Summary

IFI and IFI-dual manage to encourage female students to an IT education and provide the opportunity for a guided (in the dual option) or a self-made (in the non-dual option) career. The retention study shows that the program as a whole is convincing for students, for graduates in their look back and for employers. The program is suited to establish a solid technical self esteem. The program does not only serve to attract young women to IT, but it makes them stay in the field with a feeling of belonging. This is the main result of the retention study that strongly supports the concept of the IFI program as introduced.

Right from the beginning, IFI has been one of the degree programs at Hochschule Bremen with the highest proportion of students from migrant backgrounds. The proportion is constantly around 30% with varying countries of origin depending on the global political situation (from Afghanistan to Iraq and Iran to Syria and the Ukraine). In many of these countries of origin, IT is gendered differently than in the western world and is seen as a solid career option for young women who want to be economically independent. Here, the dual study option at IFI in particular contributes to the

successful integration of very heterogeneous student groups – at the Hochschule and in their further life in Germany.

IFI + IFI-dual: Reference list

[1]   Hochschule Bremen: https://www.hs-bremen.de/internet/en/index.html

[2]   IFI: https://www.hs-bremen.de/internet/en/studium/stg/ifi/index.html
         rsp.   https://www.hs-bremen.de/studieren/studiengang/internationaler-
         frauenstudiengang-informatik-b-sc/

[3]   Internationality   https://www.hs-bremen.de/internet/en/international/

[4]   Dual studies   https://www.hs-bremen.de/studieren/studiengang/internationaler-
         frauenstudiengang-informatik-dual-b-sc/
         rsp.   https://www.hs-bremen.de/en/study/degree-programme/cooperative-
         international-womens-degree-programme-in-computer-science-bsc/

[5]   HTW Berlin, women´s program   https://fiw.htw-berlin.de/

[6]   Competence Centre Technology - Diversity - Equal Opportunities, Bielefeld
         https://www.kompetenzz.de/english-information

[7]   DZHW - German Centre for Higher Education Research and Science Studies (DZHW)
         https://www.dzhw.eu/en/gmbh/index_html

[8]   Results of the retention study:

- Poster at GE@ICSE24: https://conf.researchr.org/details/icse-2024/ge-icse-2024-papers/11/Software-Engineering-Education-including-Single-Sex-Phases-Is-there-an-Impact-on-Self Concept and Professional Career? A Retention Study
- Presentation of the retention study at the Conference
  Women in IT - Sustainable Success Factors for Studies and Career, Hochschule Bremen, May 2024, with various reports and videos in Bremen media:

  https://www.butenunbinnen.de/videos/frauenstudiengang-informatik-100.html
  https://www.hs-bremen.de/die-hsb/aktuelles/nachricht/studie-belegt-internationaler-frauenstudiengang-informatik-der-hsb-staerkt-weiblichen-anteil-in-it-berufen/

  https://www.butenunbinnen.de/nachrichten/frauenstudiengang-informatik-hochschule-bremen-100.html

  The conference proceedings including the retention study in all details will be published in November24 by Peter Lang Verlag.

- https://kompetenzz.de/aktivitaeten/monoedukation-und-beruflicher-erfolg
  gives a detailed description of the retention study as well as a short version.