The Bamberg CS30 Strategy

Nomination of the WIAI Faculty (Information Systems and Applied Computer Sciences) at the University of Bamberg
for the Minerva Award 2018

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Summary

In 2014, the WIAI faculty in Bamberg reached a milestone: The female gender ratio for first-year students in CS-related courses reached 30,4% (and is still increasing). I joined the faculty in that year and found that these figures are not a random outlier, but the consequence of a coherent strategy to encourage and retain female students. It currently contains 12 actions, spanning a broad range of ages and life situations (from elementary schools over support for enrolled students up to alumnae tracking). The actions are continuously evaluated, not only for their impact, but also for new insights on gender studies.

Nomination

As present Dean of Studies, I strongly believe that the actions of this strategy not only caused the still increasing female gender ratio, but also contributed to great success of our CS programs in general (as shown by the latest CHE rankings for computer science and business computing).

Hence, it is my pleasure to nominate the Bamberg CS30 strategy and its driving force, Ute Schmid, for the 2018 Minerva Informatics Equality Award.

The Bamberg CS30 Strategy

Since 2005, the women's representatives of the Faculty of Information Systems and Applied (WIAI) Computer Science at the University of Bamberg have initiated and extended a broad range of activities that give girls and young women the opportunity to get a realistic idea of and to discover their interests and talents for computer science. The object of these activities is to reach a female/male ratio of at least 30% across all computer science programs so that women studying computer science are not perceived as a minority. Enrolled students are supported with several measures so that almost all students that have once enrolled in a computer science program follow their course of studies until successful graduation. The single actions of the Bamberg CS30 Strategy are continuously evaluated to measure their impact on enrollment and retaining of female computer science students.

Actions of the Bamberg CS 30 Strategy

1 Encourage female students to enroll in a CS program

Several mono- and co-educational programs for girls of different age groups have been established at the WIAI. These programs offer different workshops with a broad range of hands-on-activities in various fields of computer science. The programs address all age groups from 5 years (preschool) up to 18 years (senior high schoolers). Thus, the interest in computational topics can be awakened before gender-specific talent attributions and sex-role identities come into effect. The experience has demonstrated that mono-educational workshops strengthen computational self-efficacy beliefs and contribute to a realistic self-perception of girls, especially during puberty. Co-educational programs are suitable for younger children at preschool and primary school in order to demonstrate that computer science is in interesting field for females and males. During puberty and adolescence, co-educational programs combined with mono-educational programs affirm girls that they are as talented as their male counter-parts. In addition to these programs, we offer visits and give talks at local high schools to further strengthen the link to the university.

I4Kids – Elementary Computer Science [1]: A program for children aged 5 to 10 years. A computer science experimenters' kit has been conceptualized and can be borrowed for free by kindergartens and primary schools. The kit comprises unplugged-materials that allow children to explore basic computational concepts. In addition, several digital devices with applications are included that enable children to understand the importance of the computational concepts for the functioning of computer systems and to gain first programming experiences. Furthermore, workshops for preschool and primary school children of both sexes are offered that foster transferable knowledge about the handling of computer systems combined with the impartment of the underlying computational concepts.

MuT – Mädchen und Technik ("Girls and Science", [2]): An annual three-day workshop program for girls from 10 to 14 years of age. The focus is on hands-on experiences with a variety of topics such as robot programming, computer game programming, social networks, and human-computer interaction.

Girls' Day at the WIAI [3]: The Girls' Day is a German wide annual event. In this context, the WIAI offers 3-hour workshops, mini-lectures, and information about the different interdisciplinary undergraduate programs in computer science for girls aged 14 to 18 years.

Freak-IT [4]: A co-educative program for senior high schools. Hereby, the chairs of the faculty offer a variety of workshops that are related to the research activities in applied computer science and information systems. Since 2013, Freak-IT is part of the Computer Science Day at the University of Bamberg.

Bamberger Informatiktag ("Bamberg Computer Science Day", [5]): Addresses girls and boys from 5 to 18 years and includes workshops for younger students, open-labs and presentations for older students, teachers and the interested public. Students and teachers are also encouraged to engage in and to present high-school projects on computer science. Thus, relevant stakeholders (like teachers or parents) learn that CS is an interesting and future-oriented profession for girls as well as for boys.

makeIT [6]: A mentoring program that addresses high school students aged between 16 and 18 years, i. e. students two years before high school graduation. The program provides regular contact to mentors who are studying a computer science program at the WIAI, the opportunity to attend computer science lectures together with the mentors, and a computational project day. Thus, the high school students gain an impression of a university students' everyday life as well as computer science lectures. In this way, possible fears and prejudices about the subject can be reduced.

Online information about female role models [7]: The website of the women's' commissioner contains statements and biographies of women who are studying computer science at the WIAI, female graduates and research associates as well as female computer science professors. Thus, different motives for choosing computer science as a career and experiences during course of studies and after entering the profession are pointed out. The website also provides the relevant facts about studying computer science and measures for the promotion of women at the WIAI (see Section 2).
Master degree "Computing in the Humanities – CITH [8]: This course targets students of both gender who choose computer science later in their career, e. g., with a bachelor's degree in a field pertaining to the humanities or human sciences and education. Although this course is not primarily aimed at an action to increase the female gender ratio in CS, the experience has shown that some women dare to choose a computational master degree rather than a bachelor degree in the field of computer science. An overview on all courses offered at the WIAI faculty can be found here [9].

2 Retain female students after enrollment in a computer science program

After attracting female students to enroll in a computer science program, we conduct several actions to make sure that they retain in the course, graduate sucessfully, and get an excellent start in their professional life.

Mentoring and Frauennetzwerk ("Female Network", [10]): To support female students during their course of studies, a mentoring program with informal meetings between first-semester female students and women of the faculty (students from higher semesters, research associates, and full professors). These meetings and our bi-annual excursions to CS related companies support their mutual visibility and encourage networking. A mailing list informs about all events as well as external career events for female computer scientists, scholar ships or going abroad programs.

Seminar Course Gender Aspects of Computer Science Fehler! Verweisquelle konnte nicht gefunden werden.**:** Since 3 years, Prof. Dr. Ute Schmid and Prof. Dr. Kai Fischbach yearly offer a co-ed seminar, elegible for our CS related courses in the "Kontextstudium". In this seminar, both male and female students can systematically reflect own experiences in current or future work situations.

CoachNet [12]: A coaching program that supports female students during their course of studies, near graduation, and in their professional life has been established. Individual coaching sessions allow students to get aware of their own competencies and to clarify career goals. Accompanying workshops and experience reports of students and graduates about internships, international experiences or first working experiences contribute to the strengthening of self-efficacy beliefs and motivational resources. In addition, the CoachNet network enables female computer scientists to exchange and support each other at different stages of their studies / professional entry phase.

Female tutors as role models: Women who are studying the master degree „Computing in the Humanities" are typically more experienced than first year computer science students. Thus, they are encouraged to work as tutors and to serve as positive role models for younger female students.

3 Evidence of impact

The strategy of the WIAI faculty to offer several actions to fully cover different age spans has shown an impressive impact. We continuously evaluate the impact of all strategy actions. In addition, we can demonstrate a Germany-wide leading gender ratio in CS related courses.

3.1 Continuous evaluation of the strategy

Evaluation of the junior programs (I4Kids, MuT, Girls' Day, Freak-IT, Computer Science Day, makeIT): All junior programs are evaluated for quality and also for impact of the participation on attitudes towards computer science, motivation and interest in computer science as profession. Results show that participation has a positive (short-term) impact on attitude, motivation and professional plans. About 30% of all participants take part more than once.

First year student's survey: The satisfaction with the course of studies, supervision during course of studies, gender-sensitive course content and teaching is annually evaluated among first and second year students at the WIAI. The insights of the survey are used for the derivation of gender-sensitive teaching measures and the further development of the strategy. One example for a new planned action is a training program for tutors that covers gender aspects like differences self-efficacy beliefs and potential deficiencies in practical engineering experiences (**Starting From Zero Tutorial**, low level support for all students, starting in winter term 2018).

Alumnae Tracking project: The aim of the research project "Alumnae Tracking" [13] (2012 – 2015) was to track career paths of female students and graduates of the WIAI since the foundation of the faculty in 2002. Therefore, career paths of women were compared to career paths of men. The project gave insights in sex-specific academic achievement, professional self-efficacy beliefs, career chances and career aspirations. The results helped to shape new strategies to attract young girls in the field of computer science and to prevent female students and scientists from dropping out of the STEM pipeline. As a consequence, the coaching program described above and the mentoring program for high schoolers (makeIT) has been implemented. We continue to evaluate the impact of our actions in the scope of the university's quality management, which has just been successfully accredited.

3.2 Gender ratio statistics

Total number of students: Figure 1 shows the number of students enrolled in CS related course at the University of Bamberg (WIAI faculty). We are proud to see that along with the actions of the Bamberg CS 30 strategy, not only the total number of female students, but also the gender ratio at the WIAI is also constantly increasing from about 12% in 2005 to nearly 30% in 2018. Thus, the proportion of female students at the WIAI is above the mean German-wide proportion (20.8 % in 2016) and outnumbers the German gender ratio since 2012 (see Figure 2).

First year students: Compared to the German-wide situation, the proportion of female first year students at the WIAI exceeds the mean German-wide proportion since 2010/2011 (see Figure 3).

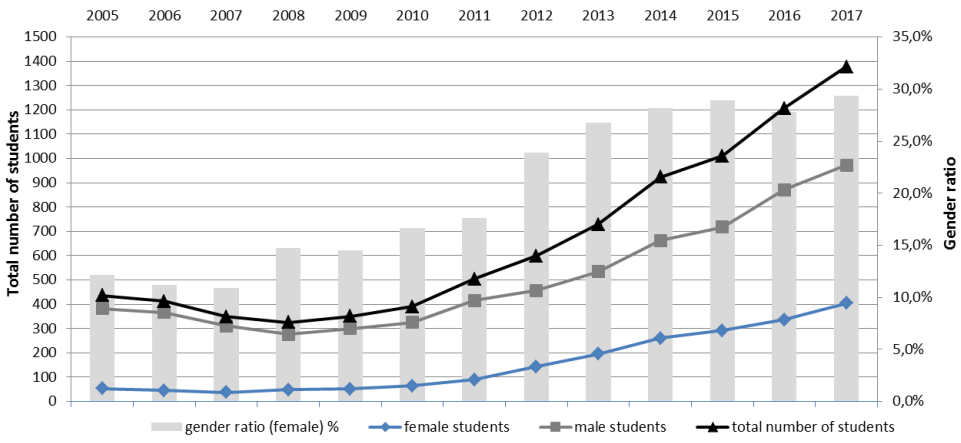

Figure 1: Gender ratio and total number of students at the WIAI Bamberg
Source: University of Bamberg

By the winter semester 2012/2013, the WIAI faculty **set a new record within Germany**. The gender ratio for first year students reached the 30% mark for the first time: 35.1 % of all first year computer science students were women. The proportion of over 30% female students among first-semester students has been maintained since 2014/15.

Graduates: Comparing the gender ratios of female first year students with the female graduates 4 – 5 years later indicates that a high percentage of women who choose computer science as a career successfully graduated. The supporting measures during the course of studies successfully contribute to the retaining of female computer science students until graduation. It seems that even more female students than male students could be retained. Thus, several measures such as the mentoring program makeIT, the coaching program and the excursions have been opened for male students, too. Thus, a more deliberate choice of studies by male students is fostered and support for motivational problems that occur during the course of studies is offered.

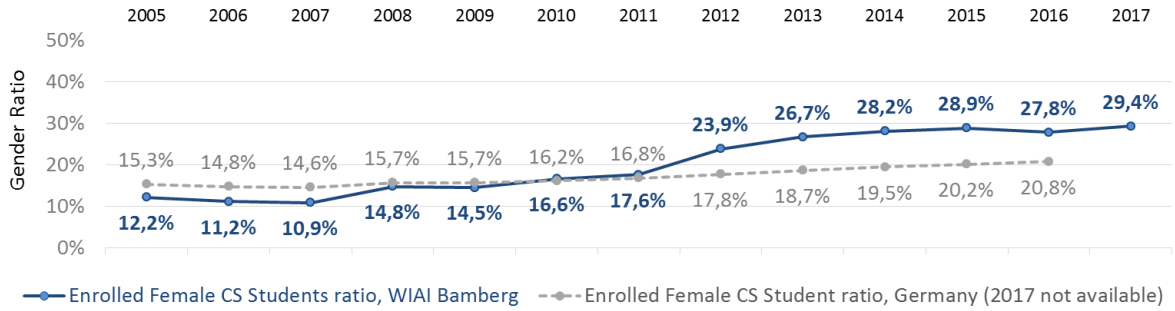

Figure 2: Gender ratio in CS related courses (Winter term). Sources: University of Bamberg and [16]

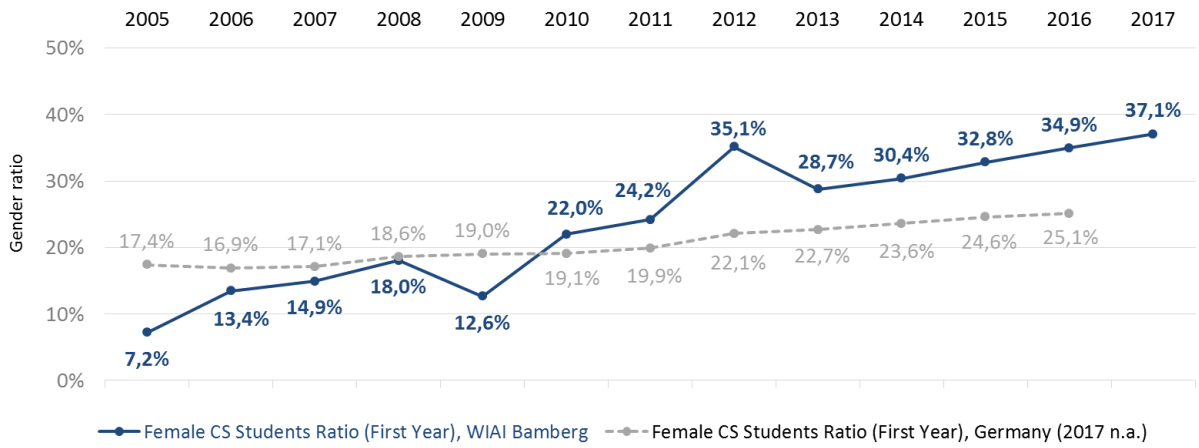

Figure 3: Enrollment statistics: First year student gender ratio in CS related courses (Winter term)
Sources: University of Bamberg and [14]

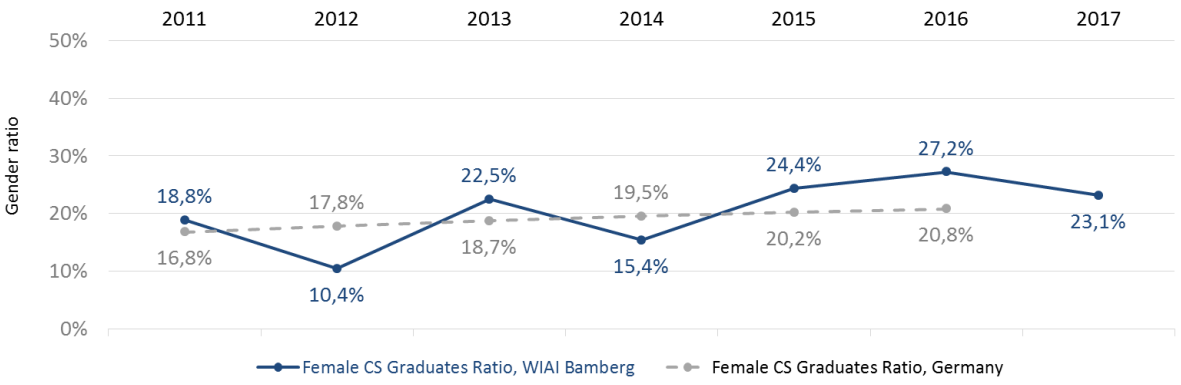

Figure 4: Graduation statistics: Gender ratio of female graduates in CS related courses
Sources: University of Bamberg and [14]

4 Reference list and URLs of supporting material:

Letters of Support:

- Dr. Ursula Köhler, speaker of the special interest group “Women in Informatics” of the German Informatics Society
- Dr. Isabel Roessler, project manager at CHE, Centre for Higher Education Development, Germany

The high percentage of female first year computer science students in Bamberg was honored German-wide and reported on relevant websites:

- Website of **The National Pact for Women in STEM Professions** - "Come, Make MINT." This nationwide networking initiative wants to inspire girls and women to involve in STEM programs and careers [14]
- Website **"Einstieg Informatik" (Entering computer science)** of the Office of the Federal Computer Science Competitions and the German Faculty Day Computer Science [15]

References and URLs of supporting material

[1] http://nachwuchs.wiai.uni-bamberg.de/i4kids/
[2] http://nachwuchs.wiai.uni-bamberg.de/mut/
[3] http://nachwuchs.wiai.uni-bamberg.de/girlsday/
[4] http://nachwuchs.wiai.uni-bamberg.de/bit/archiv/freak-it-2012/
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[11] https://www.uni-bamberg.de/en/cogsys/teaching/courses/seminar-genderaspekte-in-der-informatik/
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[15] https://www.einstieg-informatik.de/index.php?article_id=393&sid=739
[16] Competence Center for Technology, Diversity and Equal Opportunities 2018, https://kompetenzz.de/Daten-Fakten/Studium