From Discovery of Own Talent to Professional Confidence --
Removing Barriers and Strengthening Self-Assurance of Women in
Computer Science

Ute Schmid
Women’s Representative of the Faculty Information Systems and Applied
Computer Science (WIAI), University of Bamberg
• Let girls and females (and everybody else) discover their inclinations and talents (in STEM, in informatics)

• Allow for freedom of choice for a (STEM) degree of study and career (overcome structural, social, and personal barriers)


Credit: Luis Alvarez / DigitalVision / Getty Images
Outlook

• Introducing the Faculty WIAI at University of Bamberg

• Encouraging and Recruiting Females to Study Informatics
  ➔ Measures
  • Observations and Empirical Findings

• Retaining Female Students
  ➔ Measures
  • Observations and Empirical Findings

• Careers of Women in Informatics
  ➔ Measures
  • Observations and Empirical Findings

• Lessons Learned (so far ...)

Nov. 2022 | Ute Schmid | University of Bamberg, WIAI
Enrollement statistics

Winter term 2021/2022

Minerva Award (2018)

2014: > 30%
Europaweit beste Frauenförderung in der Informatik. Preis „Minerva Informatics Equality Award“ geht an die Universität Bamberg

Die Universität Bamberg bekommt als erste Hochschule im deutschsprachigen Raum den „Minerva Informatics Equality Award“.

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
### Erstsemester WIAI Studierende im WS21/22

<table>
<thead>
<tr>
<th>Studiengang</th>
<th>Erstsemester</th>
<th>Studierende männlich</th>
<th>Anteil</th>
<th>Studierende weiblich</th>
<th>Anteil</th>
<th>Studierende divers</th>
<th>Anteil</th>
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<td>73,2%</td>
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</table>

21,8% on average in Germany
Encourage and Recruit


Online information about role models
Master degree „Computing in the Humanities“

Continuous evaluation of strategy actions
The Bamberg CS30 Strategy

Continuous evaluation of strategy action:
Empirical research

Effects of actions?
Which actions are effective?

Effects of actions?
Which actions are effective?
Elementarinformatik I4Kids

- Experimentierkiste „Informatik“
- Workshop Scratch
- Workshop Digital Poster
Empirical Evaluation of the Computer Science Experimenter’s Kit: Maike Wolking & Ute Schmid, WiPSCE 2017, Mental Models, Career Aspirations, and the Acquisition of Basic Concepts of Computer Science in Elementary Education
Empirical Evaluation of the Computer Science Experimenter’s Kit: Maike Wolking & Ute Schmid, WiPSCE 2017, Mental Models, Career Aspirations, and the Acquisition of Basic Concepts of Computer Science in Elementary Education

Systematic Observations (2 kindergartens, 1 primary school)

- Knowledge/preconceptions about job characteristics
- No idea about gender proportions in different jobs
- Rating of Interest Before/After
Workshops: Programming with Scratch/Digital Poster

- Gender specific strategies
- Can be observed starting about at age 8-9 (3rd grade):
  - Girls work planful, boys explore
  - Girls program interactive stories, boys program games
    (introduce variables for scores!)
Holiday workshops for girls from age 10 – 14
Pre-/post questionnaires show robust short-term effects of the measures on changes of attitudes towards informatics.
Are specific programs for girls (still) necessary?

Yes, it seems so:

- Same workshop offers for MuT (girls only) and BIT (mixed)
- > 50 girls every year at MuT
- > 12-20% girls at BIT
Mentoring for high school students
Mentors are CS students
Empirical Findings

- Bettina Finzel, Hannah Deininger, Ute Schmid, From Beliefs to Intention: Mentoring as an Approach to Motivate Female High School Students to Enrol in Computer Science Studies, GenderIT 2018

Diagram:

Mentoring functions:
- role modeling
- counseling/information
- acceptance-and-confirmation/skill development

Theory of Planned Behavior:
- normative beliefs
- behavioral beliefs
- control beliefs
- subjective norm
- attitude
- perceived behavioral control
- intention
- behavior
Empirical Findings

Hannah Deininger, Bettina Finzel, Ute Schmid, From Beliefs to Intention: Mentoring as an Approach to Motivate Female High School Students to Enrol in Computer Science Studies, GEWINN 2018

<table>
<thead>
<tr>
<th>Table 2: Measures and their assumed effect on mental barriers to study computer science.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentors as role models</td>
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<tr>
<td>Specific information about computer science studies and occupational profiles</td>
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<tr>
<td>Hands-on experience and explicit feedback addressing underestimation and negative beliefs</td>
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</tbody>
</table>

![Chart showing the results of a question about whether the Einblick in die Informatik in the IT aspect at the study of Informatik was discovered, which has particularly appealed to you (n=22). The chart shows 10 no responses and 12 yes responses.](chart.png)
## Teilnahme unserer Studierenden an Nachwuchsprojekten

<table>
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<th>Jahr</th>
<th>MuT (w)</th>
<th>Girls Day BA</th>
<th>Girls Day BW</th>
<th>BIT (w)</th>
<th>BIT (m)</th>
<th>BIT (w/m)</th>
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<th>makeIT (m)</th>
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<td>17</td>
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**Gesamt**: 6, 18, 78, 4, 12, 21, 3, 1, 7, 1, 23, 63, 163, 53, 294

**BA** = Bamberg; **BW** = Bundesweit; **w** = weiblich; **m** = männlich; (w/m) = weiblich und männlich gemeinsam; **BIT** = Bamberger Informatiktag (bis 2014 FreakIT); **TAO BA** = TAO Schülerforschungszentrum Standort Bamberg; **MINT** = weitere bundesweite Schüleraktionen aus Mathematik, Informatik, Naturwissenschaft, Technik.
- Female tutors as role models
- Mentoring and Networking (excursions to software companies)
- Seminar Course Gender Aspects of Computer Science (since 2015 each summer term)
- CoachNet: Individual coaching for career development (Project funded by Adecco and Rainer Markgraf Foundation 2016-2020)
Networking projects

Lunch Meet Up
• Weekly virtual meeting during online lecture period (pandemic period)
• For female students, university staff and scientific staff

Ada Study Space - by women* for women*
• Space and time for exchange and support between female* students, coworking and save space
• More experienced and new female students support each other
• Weekly during lecture period
Role model project

- Video Interviews: female students talk about university live and their course of studies
- Computer Science and Applied Computer Science
- Three central questions:
  - Who are you and how did you get to your course of studies?
  - What do you do besides your studies?
  - What do you like best about your course of studies?
Female students in Applied CS have significantly better grades in mathematics (much better than average in Bavaria)

Data from summer 2019:
- WI: 22w, 48m
- AI: 5w, 26m
- CitH: 16w, 0m

Effects are similar over the years (since 2011)
Study Motivation

Talent and interest are stronger Motives for CS than for business informatics
Career opportunities and salary are stronger motives for business informatics than for CS.
Female students rate their own success lower than male students, but grades in intro cs are better.
Mutual Perception of male/female students in computer science

Open question: name three typical characteristics of your female/male study colleagues (answers of 30 female, 51 male)

(Grünauer, S. & Knauf, D., 2015)
Questionaire for students of computer science and education (vf. Meis, L. et al., 1993)

“Draw a typical female computer scientist.”
“Draw a typical male computer scientist.”

(answers of 29 cs students (7 female) and 30 education students (24 female)
Informatikstudentinnen: (most frequent adjectives)
• ambitioniert
• selten
• freundlich
• kooperativ
• intelligent
• nicht attraktiv

Informatikstudenten: (most frequent adjectives)
• introvertiert
• technikaffin
• kooperativ
• intelligent
• seltsam („nerdig“)

Semantic differential
Image Study

Zeichnung

einer typischen Informatikerin  eines typischen Informatikers
Research project Alumnae tracking

- ESF project, 01.10.2012 - 31.03.2015
- Evaluation of female and male careers of computer science students in Bamberg
- Covering students and graduates since 2003
- Interviews with HRs of over 30 companies

Main results concerning female students:
- Significantly better high school math grades than males
- Mis-match of self image and study success
Alumnae tracking ... interviews with:

Person

Geschlecht

Subjektive Faktoren
- Selbstkonzept
- Rollenkonzept
- Leistungsbereitschaft
- Lebensziele
- Berufliche Ziele

Objektive Faktoren
- Abschlussnote
- Zügiges Studium
- Berufsbezogene Erfahrungen
- Mobilität

Privates Umfeld
- Kinder/Pflege
- Unterstützung durch Partner
- Unterstützung durch Familie/Freunde

Berufliches Umfeld
- Arbeitsplatzgestaltung
- Fördermaßnahmen
- Rollenmodelle
- Unternehmenskultur

Beruflicher Erfolg
- Gestaltungsfreiheit
- Führungsverantwortung
- Verdienst

Lebenszufriedenheit

Berufliche Zufriedenheit

Graduate

Students

Companies
Life goals and work goals

Wichtigkeit verschiedener Lebens- und Arbeitsziele


*/**/*** signifikant auf 10/5/1% Niveau
Frauen mit Führungsposition (n = 12)
Frauen ohne Führungsposition (n = 25)

Zufriedenheit mit...

1: sehr unzufrieden; 7: sehr zufrieden

*/**/*** signifikant auf 10/5/1% Niveau

Wednesday, 26 October 2022

WIRE-EUGAIN WS - "Attracting & Retaining Female Students from Bachelor and Master to PhD" (parallel sessions)

(Venue: Geomatikum H6)

Workshop Chairs: Karima Boudaoud, Université Côte d'Azur, Barbora Buhnova, Masaryk University, and Letizia Jaccheri, NTNU.

- 09:00 - 09:10 Opening and Welcome from the Workshop Chairs
- 09:10 - 10:30 Session 1. Working Groups Updates (Chair: Özge Misirli, Eskisehir Osmangazi University)
## Working Groups

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Leader</th>
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<tbody>
<tr>
<td>1</td>
<td>From School to University</td>
<td>Dr Monica Landoni</td>
</tr>
<tr>
<td>2</td>
<td>From Bachelor/Master Studies to Ph.D.</td>
<td>Prof Erika Abraham</td>
</tr>
<tr>
<td>3</td>
<td>From Ph.D. to Professor</td>
<td>Dr Steve Kremmer</td>
</tr>
<tr>
<td>4</td>
<td>Cooperation with Industry and Society</td>
<td>Ms Fanni Bobak</td>
</tr>
<tr>
<td>5</td>
<td>Strategy &amp; Dissemination</td>
<td>Dr Valentina Lenarduzzi</td>
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</tbody>
</table>
Lessons learned ... so far

- Start early, keep going
  - Actions for all ages to build awareness of computer science as an option
  - Only hands-on experience supports change in self-perception
  - Build up a network with active teachers

- Positive effects for everybody
  - Before studies: better visibility for CS courses
  - During studies: make students aware of gender biases

- Make it a mission for the whole faculty!
Thank you!

- Prof. Dr. Daniela Nicklas for her active support of gender measures since 2014

- Many faculty members for their continuous support of our actions (offering workshops, support female students, …)

- Caroline Oehlhorn and Daniela Nicklas as Vice Faculty Women Representatives, for supporting actions for female students and university committee work

- Leonie Ackermann, Clara Morrisey, Alina Tenne, Hannah Feldmann, Bettina Finzel, Hannah Deininger, Sonja Grünauer, Kristina Prümer, Jonas Troles and many more: Team of student assistants

- Franziska Paukner, Sanne Grabisch, Tanja Fiehl, Silvia Förtsch, Romy Hartmann, Laura Folter, and most of all Anja Gaertig-Daugts – Staff members for organizatorial and scientific support


