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Actions for Gender Balance in Informatics Across Europe

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This book is dedicated to the memory of Bara Buhnova, whose tireless efforts and unwavering dedication to promoting women and girls in the field of informatics have left an indelible mark. Bara's vision and mission will continue to inspire and guide us in our pursuit of a more inclusive and equitable future.

We also dedicate this work to all the women who came before us and who follow: our mothers, godmothers, grandmothers, and great-grandmothers, our ancestors, our sisters, and our daughters, the wisdom keepers, the ones who dare to stand up for themselves and others, and the ones who care for the community.

Your light shines on.

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A special tribute goes to Bara Buhnova, whose unwavering dedication, vision, and grace have left an indelible mark on this initiative. Bara was not only a co-leader of this action but also a beacon of inspiration for promoting women and girls in the informatics field. Her passion, perseverance, and compassionate leadership profoundly shaped the EUGAIN project. While her untimely passing has left a deep void, her mission and legacy will live on through the work of this community and the many lives she touched.

Together, we have created a work that embodies hope, progress, and resilience.

Chapter 7
WoCa Lunch: A Program for Female Students to Get Informed About PhD Studies

Milena Vujošević Janičić, Erika Ábrahám, Amal Mersni, Oleksandra Yeremenko, and Miguel Goulão

7.1 Introduction

The doctorate (PhD) or doctor of philosophy is the highest academic degree in most fields of study, including informatics and computer science. During doctoral studies, students learn to conduct independent research and contribute new insights and knowledge to their field of study. Doctoral graduates often pursue academic careers as professors and researchers, but may also work in industry, government and other fields where advanced research skills are valued.

The number of women opting to pursue a PhD in informatics is low, with around 19% of PhDs awarded in Europe [24], and 24% in the United States of America [36], making women an underrepresented minority. The impact of this is far-reaching: with a small number of female professors, researchers, and mentors, the number of role models decreases, decreasing further interest of females in informatics at

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all levels. Different initiatives exist to inform, encourage, and support women if they decide to pursue a PhD. Supporting initiatives include financial incentives and support [44], mentorship and networking [22, 30], guidance and outreach [5, 10, 30], online learning support [19, 47], and creating an inclusive environment [39, 55].

In this chapter, we present the Women Career Lunch (WoCa Lunch) program [1], a supporting initiative to help female students make informed decisions about enrolling in a PhD program. The program is crafted to explain the journey of pursuing a PhD with all its benefits and drawbacks. The program's topics are thoughtfully selected to address the challenges and considerations women may face in their academic careers. It gives guidelines through informing female students about others' successes, problems, and experiences. The program has a broad range of positive impacts, including an increased number of female PhD students, their improved success rate, and an increased awareness of gender inequality in informatics, and it contributes to establishing a network of women in informatics.

⊙ **Personal Experience Sharing: The WoCa Lunch Story**
The idea for this program came up through contacting female students with PhD offers and recognising the diversity of their questions. After maintaining regular but unstructured discussions with them for a while, it has become obvious that we need to define and structure the topics to be discussed clearly for effectivity and repeatability.

Based on our first experiences and careful considerations of further relevant topics, a survey has been designed to identify typical areas of uncertainties which might hinder gifted students from enrolling in a PhD program, keeping an eye also on gender-based differences. Evaluating more than 850 answers from 53 countries served as an excellent basis for the topical design of a program, which we named *Women Career Lunch*, or short *WoCa Lunch*.

Although PhD requirements are similar everywhere, they also have specificities depending on the country and the university. Different educational contexts may require tailored approaches, and the opportunities after completed studies change dynamically. Therefore, different adaptions of the program implementation might be necessary to accommodate diverse backgrounds, institutions, and cultural settings.

Who Can Benefit from This Chapter and How?
This chapter is aimed at teachers to assist in launching the program and students who do not have a WoCa Lunch program organised at their university.

Kim, the university professor. Kim wants to encourage outstanding female students to enrol in PhD studies. Kim reads about the impacts of the WoCa Lunch program and the different ways the program can be adapted to her environment. Kim is pleased to have a catalogue of questions, answers and practical instructions about organising the program. The decision of whether to enrol in doctoral studies is not easy. Thanks to this program, female students will make informed decisions!

Deniz, the student about to graduate. Deniz does not like that her university does not organise programs or initiatives supporting the transition to doctoral studies. Fortunately, she comes across this article and decides to read the questions, answers, and personal experiences listed in the article. After reading, she understands better the essence of a doctorate and its opportunities. She knows which questions to seek further answers to and whom to approach. She feels encouraged by the new insights.

Instructions on How to Read This Chapter

To make the text easier for teachers and students, we marked paragraphs concerning specific topics in the following way.

⊗ ***Questions and answers***
Each module's questions and answers are given in paragraphs marked with ⊗ sign.

□ ***Questions for a personal experience discussion***
Questions for personal experience sharing are in paragraphs marked with □ sign.

⊙ ***Personal experience sharing***
Personal experiences examples are given in boxes marked with ⊙ sign.

△ ***Impact of the program***
Different impacts of the program are given in paragraphs marked with △ sign.

◯ ***Instructions for organising the program***
Organisational instructions are given in paragraphs marked with ◯ sign.

Overview of the Chapter

Section 7.2 starts with an overview of existing supporting initiatives. Section 7.3 provides all the necessary information and instructions to assist teachers considering launching the WoCa Lunch program at their institution. We describe in detail the modules of the WoCa Lunch program, each module's purpose, relevant questions and some possible answers for an interview-style discussion, supplemental questions for personal experience discussion, and examples of individual experiences. Section 7.4 discusses the program's broad range of long-term and short-term effects. Section 7.5 explores various options for adjusting the program. Finally, Sect. 7.6 concludes and outlines open questions and possible directions for further work.

7.2 Encouraging Initiatives

Despite the efforts made to smooth the transition from undergraduate and master's studies to PhD programs, female PhD students are still underrepresented in informatics, especially those belonging to ethnic minority groups, candidates with children, candidates with special needs, or international students, to name a few subgroups. Studies have pointed out a few common reasons for this lack of participation, including but not limited to financial constraints, societal and familial obstacles, emotional and psychological barriers, and exclusionary practices such as stereotyping, sexism, and workplace hostility [1, 5, 17, 37].

In response to these challenges, various initiatives have been established globally to support females and underrepresented groups in their academic path in informatics. These initiatives can be grouped into four main categories (1) regulations, (2) pedagogy and education, (3) financial support, and (4) guidance and engagement. Each category offers distinct strategies and advantages tailored to specific aspects of the problem.

Regulations focus on creating long-term structural change within institutions by promoting equity and non-discrimination through policy reform. Pedagogy and education initiatives target immediate improvements in teaching methods, curricula, and educational practices to make learning environments more inclusive and supportive. Financial support addresses economic barriers by providing scholarships and grants, allowing students to focus on their studies without financial stress. Lastly, guidance and engagement programs offer mentorship and networking opportunities to help students navigate academic and professional challenges.

This section explores various initiatives designed to address these challenges, each dedicated to resolving specific barriers faced by females and underrepresented PhD students in informatics. Figure 7.1 provides a visual overview of the initiatives mentioned.

7.2.1 Regulations

Regulations that provide an inclusive institutional culture can support minority involvement in informatics. Fostering a supportive and gender-neutral atmosphere involves creating policies such as gender equality in the institution, anti-discrimination, and unbiased recruitment. The hoped-for result is higher recruitment and retention rates. This understanding has encouraged many European institutions to approach exclusion and discrimination proactively. Universities have initiated policy- and strategy-building projects to create an inclusive and diverse atmosphere where women feel supported. An example is the gender-sensitive code of conduct that the Norwegian University of Science and Technology (Norway) created to follow a systemic approach towards building anti-discrimination practices in its teaching and learning methods [51].

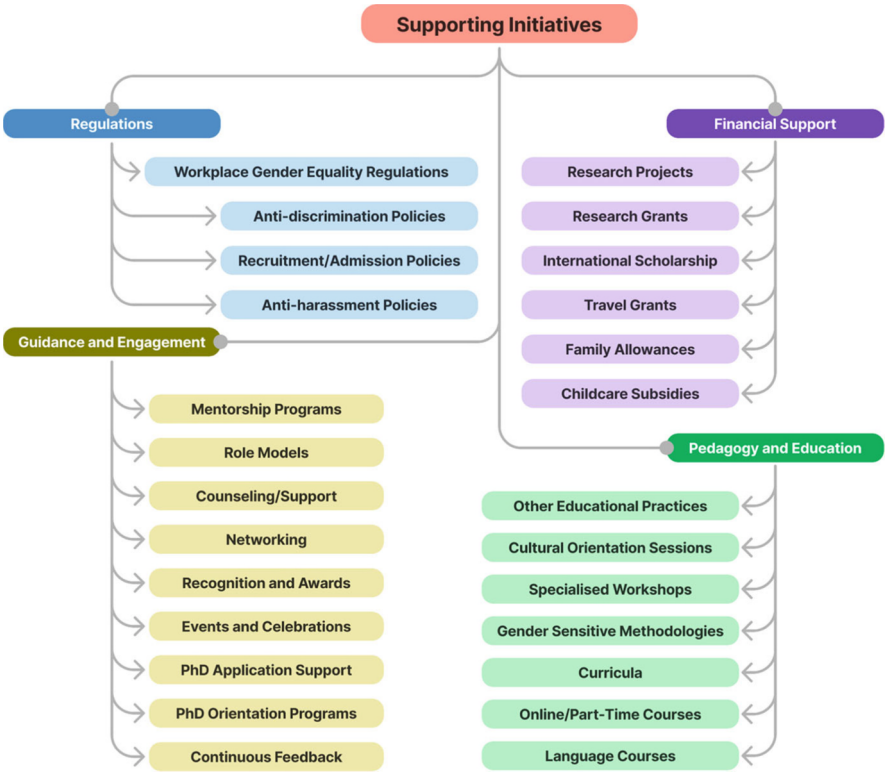

Fig. 7.1 Supporting initiatives for underrepresented groups in informatics doctoral programs

Another way European universities have chosen to fight against harassment and gender bias is by setting up various anti-bias committees. For example, the LIS Computer Science Lab, Aix Marseilles University (France) has a Gender Equality and Anti-Harassment Committee, with the mission to address stereotyping and fight sexism. The Committee aims to support their lab staff in removing barriers to promotion and offer legal and psychological support [31]. Similarly, the University of Rennes (France) established the gender-equality Committee at IRISA and the Anti-harassment Committee at Inria [29].

The Institute for Computing and Information Sciences of the Radboud University in Nijmegen (Netherlands) has implemented effective recruitment initiatives. Their best practices include hiring female researchers as a stepping stone to later promotion, broad-based recruitment for a diverse student body, and providing academic and psychological support to female staff and students. These strategies have proven successful in increasing the representation of women in their programs [27].

Chalmers University of Technology (Sweden) implemented gender equality practices with the Gender Initiative for Excellence. A university foundation considers it the highest individual contribution to affect academic culture through systemic changes in recruitment and procedural practices to achieve gender parity [55].

The Computer Science Department at the Technical University of Dublin (Ireland) implemented the highly outstanding SUCCESS initiative. It is a seven-year-long action aiming to increase the number of women in their computer science program by supporting female faculty. This program focuses on achieving gender parity, including recruitment, career, work environment, and support [28].

7.2.2 Pedagogy and Education

In addition to regulatory actions, enough attention must be paid to improving pedagogy and education to create and implement inclusive and equitable teaching, learning, and assessment methods. An example of this type of action is Koc University (Turkiye), which has developed gender-responsive strategies. Their best practices include creating physically and psychologically safe spaces through inclusive curricula, materials, and evaluation methods. Their work also focuses on raising awareness of gendered biases and women's empowerment as a skill area [41].

The COVID-19 pandemic has led to a considerable increase in the use of distance learning resources and formats, which helps to recruit more female doctoral students. Online PhD programs in fields like information technology [1, 47] highlight the growing need for such flexible educational models. Additionally, the opportunities for remote meetings and recorded lectures represent significant changes that could particularly benefit women with families, enhancing female participation in PhD programs. The best practice example for this is an online *Computer Science and Information Technology* program from the Sudan University of Science and Technology (Sudan). Due to the problem of finding qualified teaching staff, the program was designed to bring mentors from well-known universities and aspiring women PhD candidates from Sudan. In its sixth year, its success is evident in nine women and two men having already completed their degrees [47].

Since 2020, the Computer Science Department at Carnegie Mellon University (USA) has offered PhD students an open-access course named *CS-JEDI: Justice, Equity, Diversity, and Inclusion*, focusing on diversity, equity, and inclusion (DEI) in computer science. This course is a compulsory subject for first-year PhD students, and its content is created and curated by PhD students based on their personal and institutional knowledge. Instructors, carefully chosen to suit DEI's theme and the underlying principles, complement the course [32]. Also, the Norwegian University of Science and Technology offers a course on gender equality called *TDT10—Gender and Diversity in Software Development*. The course aims to explore the

place of gender and diversity in software development and how the field can be enriched through increased inclusivity [49].

7.2.3 Financial Support

Financial support is crucial for many women considering an advanced degree, as the time for a PhD often coincides with starting or raising a family. A woman with family responsibilities might hesitate to allocate the time and finances needed to start and sustain a PhD in various fields, including informatics [1, 43].

In recent years, many financial incentives and support in terms of scholarships, research grants, and, in some cases, stipends have been introduced to cover the tuition fees and other costs for women [1, 44]. Google PhD Fellowship program [35] and Microsoft Research Women's Fellowship [46] are two of those, as well as the Diane Lemaire Scholarship [58] offered to women in IT to enhance their research capabilities.

Koc University (Turkiye) has a scheme to help women academicians who take a break to start a family get back on their academic career track. The scheme provides financial and social support for a smooth transition into teaching and research [59].

Another way to support women in informatics is through various research projects. A few notable examples include the European Network for Gender Balance in Informatics (EUGAIN) [25], which aims to promote gender parity in informatics. The "Making Early Career Investigators' Voices Heard for Gender Equality" (VOICES) [8] project focuses on the challenges faced by young researchers and innovators, specifically those inequalities reinforced by disparities within academia linked to other social determinants, such as origin, socioeconomic status, sexuality, or ability. It promotes dialogue among various stakeholders to address the inequalities experienced in the field. *LIBRA* [20], *EQUAL-IST* [53], *FemTech.dk* [60], and *IDUN* [50] are examples of projects aiming to achieve gender equality in informatics and increase the representation and participation of women in leadership positions in life sciences.

7.2.4 Guidance and Engagement

Guidance and engagement through mentorship, role modelling (including both contemporary and historical role models), outreach events, and networking opportunities are instruments to draw women to a PhD and keep these women in the field after graduation. Some successful examples include EUGAIN Summer Schools, designed to train and assist PhD students in their research journey [26]. On a smaller scale, many universities and programs host guidance and engagement events, such as PhD-specific orientations. Many young women may not truly understand what a PhD involves and believe it is too complicated to apply for. To answer such

concerns, the Department of Computer Science at Stanford University (USA) allows young women to interact directly with PhD students and professors. Potential candidates freely ask questions that relate directly to them and understand the application and study processes [57]. Brown University (USA) takes a slightly different approach. The faculty students create a tailor-made application program for underrepresented groups and assign an application mentor to candidates who seek help [10].

Stony Brook (USA) has an outreach event where their successful PhD candidates are celebrated to inspire other young women [23]. *AnitaB.org* [6], *ACM-W* [4], *CRA Women* [21], National Center for Women and Information Technology [48], Association for Women in Computing [9], and many more, are holding similar engagement activities, all in hopes of increasing visibility and enthusiasm among young researchers to make informatics their career choice. The 2018 Grace Hopper Celebration was a landmark event for this type of action. The event brought together an international group of 20,000 representing more than 70 countries [55]. The mostly female participants represented a cross-section of ages and stages of a career in informatics. They had the opportunity to socialise and network to enhance their career prospects and be inspired by the examples set by the other participants [55].

While these initiatives are most welcome, they remain shining examples rather than the norm. The number and depth must increase to attract more young women to informatics PhD programs and into the long-term career track.

7.3 Women Career Lunch

The *Women Career Lunch (WoCa Lunch)* program was developed in the context of the European COST Action EUGAIN, to provide an effective yet low-cost, low-effort, and easily adaptable program to support female students in career advancement opportunities through PhD studies.

⊙ **Personal Experience Sharing: Pilot Executions**
The program has been executed for the first time at the Computer Science Department of the RWTH Aachen University (Germany). We have received highly positive feedback. After completion, the participants all felt well informed about PhD studies and beyond that, they reported under others increased self-confidence, and strengthened connections to other female students.

Based on the positive experiences, two further executions have been carried out at RWTH Aachen University for mathematics and informatics students, and a compressed form has been implemented at the Department of Computer Science, Faculty of Mathematics, University of Belgrade. Also, these program

(continued)

instances ended with highly positive participant feedback. An execution at the Computer Science Department of the *Universidade Nova de Lisboa* (Portugal) is in preparation.

The authors highly welcome notice from everyone inspired to try the program. We will be happy to give additional support or hear about experiences.

The program was developed based on findings from a comprehensive survey [1], designed to provide potential female PhD candidates with important information in a structured, engaging, and collaborative manner. The program is structured into modules, each of which is a cohesive unit suitable for a one-hour discussion. Participation in these modules aims to encourage students and equip them with the necessary information to make well-informed decisions about pursuing a PhD.

To facilitate dissemination and aid implementation, a multi-language version of the WoCa program is publicly available [2]. It includes detailed guidance on the structure and format, practical procedures and a comprehensive catalogue of questions for discussion within each module. This catalogue can be accessed currently in English, French, German, Portuguese, Serbian, Spanish, Turkish, and Ukrainian.

The program contains eight modules, with the first and last edge modules held in person, and six topical modules between them conducted either in person or virtually. Each module occurs during lunchtime and lasts approximately one hour. A guest is invited and interviewed within each of the six topical modules. These guests can be either members of the hosting institution or external experts. The purpose is to address the topics from a question catalogue in a friendly and familiar setting, while also providing insights into the career development of female role models.

- ***Organising Group*** The team organising the program ideally includes two moderators and administrative support. The moderators should hold PhDs and be part of the academic staff. Optimally, moderators include at least one female and one senior researcher.
- ***Inviting Guests*** Each module is held by at least one moderator and a guest experienced in the given topic. Ideally, each guest should be female, with at least one being an early-stage researcher. Guests should be partly local to the hosting department or institute, and partly external from other universities. To reduce the required effort, external guests typically participate online. Guests should be suitable role models, demonstrating enthusiasm, motivation, communication skills, and openness. They should speak the local language, as the modules are conducted in the local language. To ensure adequate preparation, each guest should receive the catalogue of questions they will be asked at least two weeks before their module.
- ***Number of Participants*** The optimal number of participants is between 10 and 20. A too-small group puts a too-strong focus on each student, and a too-large group makes it hard to establish a familiar atmosphere.

◯ ***Inviting Participants*** A program execution can be announced publicly, based on a personal invitation, or a combination of both.

- Since the program targets female students as potential PhD candidates, participants should possess relevant abilities. Personal invitations can be targeted to students with good grades in relevant subjects. It eases the invitee selection if the organisers have available students' accomplishments. Otherwise, invitees can be identified through interaction in lectures and courses.
- Open calls for participation can be sent to department-local mailing lists for students, or announced via posters. A slide with the call can be prepared and sent to all teachers in the department, asking them to show it to the students in their lectures.

In smaller departments, though the focus is on female students, one can also consider mixed groups. For an optimal environment, however, we stress the importance of maintaining a balanced composition and avoiding an underrepresentation of women.

⊙ **Personal Experience Sharing: Inviting Participants**
During the first implementations, we felt that one of the most important factors to raise the female students' interest in the program was *personal contact*. The first time we announced the program, the result of sending an email to a list was a relatively low number of registrations. However, talking to female students after a lecture and inviting them to join was very effective. Once joined, nearly all students attended all modules till program completion.

◯ ***Time and Location*** To reduce conflicts with courses and other events, good experiences were made by scheduling the modules at lunchtime, with one-hour duration each, every other week on the same day. Email reminders the day before each module are meaningful. A smaller seminar room or lecture hall is well-suited when a module is in person. If funds are available, pizza or similar easy-to-order-easy-to-share food contributes to a friendly atmosphere. If no funds are available, e.g. coffee and tea can be offered during the modules. There are no additional costs for online sessions.

◯ ***Scalability and Cost*** WoCa requires almost no funding. Funds are welcome for in-person meetings but are not necessary. There are no additional costs for online sessions. As the number of participants should be between 10 and 20, this does not require special conditions so the program can be easily implemented at any institution.

7.3.1 Module 1: Kick-Off Meeting

The initial meeting aims to help students and moderators get to know each other, make students understand the essence of the entire program, and learn what to expect from it. This is an opportunity for moderators to introduce themselves and briefly present their career paths. To further engage and motivate the students to participate, it is beneficial to briefly introduce the guests who will be participating in the program.

The meeting should also allocate time for discussion, during which students can express what they are most interested in, and which questions intrigue them the most. Let them know if these topics and questions will be addressed in a specific module. If not, expand the questions within the best-matching module.

The discussion can be initiated by posing questions and expecting public answers (when the group is small enough). Each student takes two to three minutes to answer these questions. In the case of larger groups, one can ask them to fill out an online form and then read and discuss their answers.

□ ***Questions for a personal experience discussion***

- Could you briefly introduce yourself?
- Which topics did you like the most during your studies?
- Do you consider enrolling in PhD studies?
- What would you like to learn about PhD studies within this program?
- Tell us about your research experience (if you have some).

7.3.2 Module 2: What Is a PhD?

Students should learn the objectives of a PhD, the skills that will be developed during PhD studies, and the requirements for PhD admission and completion. They should also learn about the typical day-to-day life of a PhD student.

7.3.2.1 Objectives and Skills

While many practical requirements, personal experiences, and academic and industry opportunities can significantly vary through countries and universities, PhD objectives, elements of PhD research and skills to be developed are almost constant.

⊗ ***What are the objectives of a PhD?*** PhD programs aim to train students to conduct high-quality research independently, advance their field of study, and make noteworthy contributions to academia and society. Students prepare for future challenges by staying updated with the latest research trends and methodologies while developing problem-solving abilities and critical thinking.

⊗ ***What are the elements of PhD research?*** PhD research involves independent research, which includes understanding research methodology, managing data and information ethically, and effectively communicating findings through scientific writing and dissemination such as conferences and journal publications.

⊗ ***What skills will be developed during PhD study concerning research, teaching, and leadership?*** Various skills are gradually developed through the PhD process. Carrying out research effectively assumes creativity, innovation, and self-initiative. Students develop effective time management to balance research, teaching, and other commitments. Students enhance written and oral communication skills to present research findings to academic and non-academic audiences. Conflict management skills are developed while resolving disputes or disagreements arising during research or collaborations. Project work and the guidance of undergraduate and master students shape strategic thinking, teamwork abilities and leadership skills.

⊙ Personal Experience Sharing: My Most Useful Lessons Learnt in PhD

1. It is important to choose a supervisor who suits you, even if you have to change them after realising they are not a good fit.
2. It is important to talk with colleagues doing similar work to yours, even if such conversations initially seem exhausting or require preparation.
3. It is crucial to stay updated in your field through papers, conferences, workshops, and similar activities.

7.3.2.2 Practical Requirements

PhD admission and completion requirements can vary depending on the university and program. We give a common outline that should be discussed within this module, but filling the outline with the program-specific information is important. In addition, students should get links to official pages explaining the admission process, including necessary documentation and deadlines.

⊗ ***What are the requirements for PhD admission?*** PhD admission requires a bachelor's or, more often, a master's degree in a related field. Some programs may have additional requirements, such as specific prerequisite courses. The university or program usually specifies a minimum GPA (Grade Point Average) for enrolling in PhD studies. Application documentation may require a personal statement or a motivation letter which is a document outlining the applicant's research interests, academic background, career goals, and reasons for pursuing a PhD in that particular field. This should fit with the research interests of faculty members in the program. Previous research experience, such as undergraduate research projects, master's thesis, or relevant work experience, is often valued.

PhD programs may require taking standardised or subject-specific tests (like the Graduate Record Examination test) or acquiring letters of recommendation from professors or professionals who can attest to the applicant's academic abilities and potential for research. In some cases, applicants may be interviewed during the admission to discuss their research interests and fit with the program. For international students, proof of English proficiency is usually required through tests like TOEFL or IELTS unless the applicant has completed a degree in an English-speaking country.

⊗ ***What is the typical day-to-day of a PhD student?*** The life of a PhD student involves a mix of research, teaching and academic administration tasks (if applicable). More precisely, the most common activities are:

Research work —includes brainstorming, developing novel methods for problem-solving, programming, conducting experiments, collecting and analysing data.

Research dissemination —includes attending seminars, conferences, and workshops to present research, network and discuss with peers.

Writing and reading scientific literature —Writing includes writing and editing research papers, dissertation chapters, or reports. Reading includes finding relevant literature and studying the latest research in the field.

Meetings —with an advisor or research team to discuss progress, results, and next research steps.

Teaching (if applicable) —includes preparing for and delivering lab sessions, grading assignments, and providing guidance and feedback to students.

Administrative tasks —include responding to research- and teaching-related emails, completing paperwork concerning project or funding administration, contributions to group administration, or serving on departmental commissions.

PhD students often have flexible schedules and day-to-day activities may vary based on individual preferences and project requirements.

⊙ **Personal Experience Sharing: Finding Life Balance**
The hardest is balancing work, doctoral studies, and private life. While I don't have an answer, it's important to think about it daily. Strive to ensure that no aspect suffers too much.

◯ ***Discussion on everyday PhD life*** Discussion should be based on the personal example given by the module's guest. In addition, inviting a current PhD student to present her experience on this topic is also a good practice.

⊙ **Personal Experience Sharing: The Essence of My Personal PhD Experience**

1. A doctorate (like any other scientific research) is often not a straightforward path to results but involves many ups and downs.
2. It is crucial to present your work often, through seminars, conferences, or similar events, even though this is the least appealing task for a doctoral student. Doing so provides valuable feedback regarding the work itself.
3. It is important during the doctorate (and any other research) to be proactive, meaning not waiting for tasks from the supervisor but showing initiative, proposing methodologies or activities, and similar actions.

⊗ ***What are the requirements for finishing a PhD dissertation?*** The requirements for finishing a PhD always include writing and defending a PhD dissertation. Different procedures and tasks should be completed before writing the dissertation. An initial task includes developing and defending a dissertation proposal that outlines the research objectives, methodology, literature review, and expected outcomes. This proposal is usually presented to a committee for approval before beginning the research and is written with the help of the PhD advisor. University regulations or the advisor may specify the number of published papers that should precede dissertation writing. Papers should be published at chosen scientific venues (conferences or journals). After enrolling in PhD studies, the student will learn the overall process and procedures. It is not necessary to understand them completely in advance.

□ ***Questions for a personal experience discussion***

- Why did you decide to do a PhD and what was your decision process?
- What were the elements of your PhD process?
- What did you learn through your PhD that was most useful to you?
- What advice would you give PhD students based on your experience?

7.3.3 Module 3: Why a PhD for an Academic Career?

A PhD provides the training and credentials necessary to work in academia and contribute to society. This module clarifies the process of selecting a research topic, research group, and supervisor for PhD studies, and the impact of these choices on the future career. Also, students should understand the evaluation processes of the quality of their work and the overall duration of their PhD studies.

7.3.3.1 Academic Career

Students usually see their professors only as teachers and do not completely comprehend the many other parts of professors' jobs.

⊗ ***What does an academic career look like?*** The educational pathway starts with undergraduate studies and continues through MSc and PhD studies. After earning a PhD, many academics undertake postdoctoral positions to gain further research experience and establish themselves in their field. Typically, the first full-time academic position is assistant professor, followed by associate professor and the final position is a full professor. Different university systems exist, and progressing from one level to another may depend on distinct factors. However, at all levels responsibilities include teaching, conducting research, and doing professional service. Teaching assumes designing courses, delivering lectures, leading seminars, and evaluating students. It also assumes guiding undergraduate and graduate students in their academic and research endeavours. Conducting research depends on the discipline and includes research dissemination, such as writing articles, books, and conference papers. It also assumes writing proposals to secure funding for research projects. University and professional service assumes participating in departmental and university committees, contributing to the governance and development of the institution, being involved in academic societies, peer reviewing for conferences and journals, organising conferences, writing assessments, and other professional activities.

⊗ ***How does the PhD prepare you for an academic career?*** PhD prepares for an academic career through rigorous training in many important aspects essential for conducting original research (e.g., experience in research methods, critical thinking and problem solving, teaching, academic writing and oral presentations).

⊗ ***What is important to progress to the next step in an academic career?*** After obtaining a PhD, further specialisation is possible through postdoctoral studies. Postdoctoral studies are necessary for advancement and achieving higher academic titles at some universities, while this is not the case at others. It is important to learn about opportunities and conditions at the desired university, adjust the PhD studies accordingly, plan the next steps and apply on time for suitable positions.

7.3.3.2 PhD Topic and Supervisor

Choosing a PhD topic requires careful consideration of personal interests, the feasibility of the research, and the expertise and mentoring style of potential supervisors. The PhD topic significantly influences the academic career, shaping the specialisation, research opportunities, and professional network.

⊗ ***How do you choose a topic for your PhD?*** The topic should hold significant importance for the community, and the research findings should potentially

offer noteworthy new insights. Personal interests and the possibility of long-term engagement are of utmost importance. Students should choose a topic they are genuinely interested in and passionate about, as they will be working on it intensively for several years. It should be a topic for which the student can stay motivated over an extended period. It is also crucial that the topic aligns with the expertise of potential supervisors and faculty members in the respective department. Ensure the department has the necessary resources and support for the chosen topic.

⊙ **Personal Experience Sharing: Topic vs Supervisor**
You shouldn't choose a PhD topic based on the supervisor you want to work with, but according to your interests and the relevance of the field—it's extremely problematic if you find yourself in a field that doesn't interest you. On the other hand, if the supervisor is bad, you're in trouble (I had a good supervisor, but I saw firsthand what it means to have a bad supervisor). So somehow a combination of both is necessary. Otherwise, you'll have to rely on sheer willpower.

⊗ ***How do you choose a supervisor?*** A supervisor should be supportive, accessible, and willing to provide regular feedback and guidance. To ensure a productive and supportive working relationship, the supervisor's research interest and expertise should match the chosen topic, and the mentoring style should match the working style and needs of the PhD student. A strong publication and funding record and the success of their former students in terms of completion rates indicate a successful and well-respected researcher.

⊗ ***How does the PhD topic determine your career?*** The PhD topic defines the area of expertise and often sets the direction for future research and (academic or industrial) career. This specialisation can influence eligibility for different types of positions. The research area determines potential collaborators and research networks. Certain topics may attract more funding and grant opportunities.

⊗ ***Who are your partners throughout an academic career path?*** The supervisor is the most important academic partner. They provide guidance, support, and feedback throughout the whole PhD. However, peers and colleagues are also substantial as direct collaborators and discussion partners in everyday activities. Finally, PhD students build their professional network by engaging with organisations and attending conferences. The professional network is also important for getting guidance and feedback. Collaborations with researchers from different fields widen this network for interdisciplinary topics.

⊙ **Personal Experience Sharing: Who Are Your Partners?**
You have to be proactive, not wait for something to happen, but constantly look for solutions and be persistent. If you get stuck and don't know how to solve something, go and ask everyone you can think of. Of course, sometimes you have to figure things out on your own, but in today's times and society, it's better not to work alone but to ask for help. It's difficult to work alone; it's much easier, better, and more interesting in a team, and you achieve results faster.

7.3.3.3 Timeline and Quality Assessment

The exact duration of PhD process can vary depending on the program structure, complexity of the research project, available funding, and many different personal factors. The PhD dissertation must present original research that contributes new knowledge or insights to the field and must be validated by external experts.

⊗ ***How long does a PhD take?*** A PhD typically takes between 4 and 6 years to complete. Students usually complete coursework (if mandatory) within the first two years. The remainder of the program focuses on conducting original research, writing the dissertation, and defending it.

The complexity and scope of the research project can significantly influence the duration. Projects involving experimental work or extensive data collection may take longer. Interdisciplinary research or projects requiring collaboration with other fields might also extend the timeline.

The availability of research funding and resources can impact the pace of progress. Full-time students usually complete their PhD more quickly than part-time students, who may balance their studies with work or other commitments. Life events, health issues, or family responsibilities can also affect the time required to complete a PhD.

⊗ ***How is the quality of PhD work assessed?*** The supervisor guides the research, provides feedback, and ensures that the work meets academic standards. In addition, PhD students have to publish their research findings in peer-reviewed journals or present at conferences. This serves as an external validation of the quality and relevance of the research. At least two experts review the PhD dissertation. Typically, at least one expert is external.

□ ***Questions for a personal experience discussion***

- What is your career path and did you plan it explicitly?
- How did you choose your PhD topic?
- What did you learn during your PhD and academic career?
- From what mistakes did you learn and what would you do differently in hindsight?

7.3.4 Module 4: Why a PhD for a Career in Industry?

Pursuing a PhD in informatics is an excellent foundation for a successful career, offering numerous opportunities in academia, industry and government [45]. This advanced training hones discipline-specific expertise and cultivates a broad set of transferable skills essential for various career paths, both research-intensive and non-research-intensive [56]. Engaging with industry during a PhD enhances learning and fosters knowledge exchange, resulting in graduates who are well-integrated into the industry [11]. Additionally, the personal networks that PhD candidates build autonomously align their specialised knowledge with market needs, facilitating a smooth transition from academia to industry [34]. Ultimately, PhD training is a crucial bridge between academic and industry sectors, equipping students with valuable, marketable skills for real-world applications [40].

7.3.4.1 Career in Industry

PhD is not critical nor required for many industry jobs. However, for the most interesting and challenging industry jobs, PhD provides the necessary qualifications and enables employment in higher-level research positions. There are also possibilities for doing a PhD in collaboration with industry partners. Furthermore, the PhD work's outcomes can result in the creation of a spin-off company.

- ⊗ ***What can a career in the industry look like?*** An industry career for an informatics professional can be diverse and dynamic, encompassing a wide range of roles and responsibilities. Professionals often need ongoing education, certifications, and training to keep up with rapidly evolving technologies and industry trends and advance their careers.
- ⊗ ***How important is the PhD topic for further career opportunities?*** The topic of a PhD can profoundly impact career opportunities. In industry, the practical applicability of research is crucial, with topics addressing current technological challenges enhancing employability. Research and development roles prioritise innovation, valuing PhD topics that advance technology or explore new research avenues. Deep technical expertise gained from specific issues can be advantageous for specialised roles. For aspiring entrepreneurs, a PhD topic meeting a significant market need can underpin a viable business, attracting investors and customers. A strong foundation in cutting-edge areas offers a competitive edge in product development. Research relevant to public interest and policy issues is precious in government or policy-making. Given the rapid evolution of technology, selecting a flexible topic that fosters skill adaptation ensures long-term career benefits. Lastly, sustained passion and enthusiasm for research contribute to better outcomes and a more fulfilling career.
- ⊗ ***Can I do a PhD with industrial participation?*** Industry-focused PhD programs differ across countries, companies, and fields. Many companies partner with universities and research institutions, enabling employees to pursue a PhD

through joint research projects. Some universities provide part-time or evening PhD programs, allowing professionals to maintain their jobs while balancing work and research commitments. Research fellowships or grants from industry bodies, government agencies, or private foundations can also support PhD research in collaboration with industry partners. Typically, industry-sponsored PhDs offer funding for research, including stipends, tuition fees, and access to advanced facilities and technologies not commonly available in academic settings. However, challenges include balancing work and research responsibilities and potential restrictions on publishing findings. Among the requirements for an industry-focused PhD program are eligibility criteria (e.g., citizenship, prior PhD status), a relevant academic background, a research proposal aligned with industry needs, a collaboration agreement, intensive supervision and mentorship, and a practical project focus.

⊙ **Personal Experience Sharing: Obtaining PhD with Industry Collaboration**
A PhD in industrial collaboration has its advantages and disadvantages. The benefits include working on cutting-edge technologies and fresh and relevant data. Besides gaining academic experience, one acquires industrial experience which opens up further opportunities for career development in the industry. On the other hand, the solution that needs to be implemented is not a proof of concept but a production-ready solution of industrial quality, and therefore, significantly higher demands are placed, exceeding standard academic prototypes.

⊗ ***Can PhD research lead to a spin-off company?*** PhD research with commercial potential can lead to the creation of spin-off companies. Key factors include establishing commercial viability, securing intellectual property protection, and obtaining support and funding from incubators or investors. Additionally, acquiring business skills and mentorship and building industry collaborations and networks are crucial. Numerous successful companies in fields such as biotechnology and informatics have originated from PhD research, demonstrating the potential for academic work to be transformed into marketable products and services. Creating a spin-off from academic research is a challenging but rewarding opportunity to bridge the gap between scientific discoveries and practical applications.

⊗ ***Which industry-relevant skills are acquired during a PhD?*** A PhD program cultivates essential transferable skills applicable to industry roles. PhD candidates develop project management expertise from planning to execution. Research papers, report communication, and complex concept explanations sharpen writing proficiency. Critical thinking skills evolve through data analysis and informed decision-making. Adaptability is fostered by navigating diverse

challenges, and leadership abilities emerge from guiding teams and driving initiatives.

7.3.4.2 Benefits of Having a PhD in Industry

Having a PhD in industry offers significant benefits both to individuals and society. PhD holders contribute to societal advancement by generating foundational knowledge and enhancing the productivity of their colleagues [16]. Their training is also valuable in non-research workplaces due to their systematic and analytical thinking skills and ability to handle complex problems [42]. Collaborative doctoral education addresses industry skills and equips PhD students with practical, transferable skills and broad societal impact [7]. Industrial PhD students benefit from access to data, projects, networks, and contextual understanding, enhancing their academic research and workplace contributions [12–14]. Moreover, cooperation between companies and universities encourages the former to recruit PhDs, fostering innovation and stronger cooperative relationships [15, 33].

⊗ ***What are the benefits of having a PhD towards a career in the industry?*** A PhD benefits an industry career by offering advanced economic contributions and diverse career paths. PhD holders enhance productivity and contribute to knowledge creation. Their skills are valuable in research roles and non-research positions, while their varied work experiences prepare them well for career development.

⊗ ***Is the salary with a PhD higher than that with a master's degree?*** PhD can lead to higher earning potential in certain industries and roles, but it is not a universal rule. Some companies have policies or cultures that reward higher education with higher salaries, while others may prioritise skills and experience over academic qualifications. Many factors, including industry norms, job market conditions, location, and individual qualifications, contribute to determining salary levels. While a PhD may not always guarantee a higher starting salary, it can lead to faster career progression and access to higher-paying positions over time.

⊗ ***Do domestic and foreign companies appreciate PhD training differently?*** Domestic and foreign companies may have slightly different perspectives on the merits of having a PhD, but it largely depends on the industry, company culture, and specific job roles. Some IT jobs require highly skilled individuals, knowledge of the latest technologies, and strong problem-solving skills. On the other hand, some IT jobs are not as demanding, and therefore, not in need of PhD holders.

□ ***Questions for a personal experience discussion***

- What was your career journey?
- Would your career have been possible without a PhD?
- What skills did you gain during your PhD that are substantial for your job?
- What influence does the PhD have regarding your reputation in the company?

7.3.5 Module 5: How to Find a PhD Position?

The application process might include different steps and procedures that are not simple and require time and preparation. In addition, if a student wants to apply for a position at a university where they did not study, it might be difficult to find a suitable PhD position, a group, and a supervisor.

7.3.5.1 Finding a PhD Position

Finding a PhD position, if not within the department where the previous level of study was completed, requires serious effort and time. The search for the right position should begin at least a year in advance, as it is not easy to find a well-suited position. Once a position is found, it is necessary to prepare and submit documentation following the deadlines set by the given university or research institution.

- ⊗ ***What can I do during my studies to qualify for a PhD position?*** Requirements for academic qualifications differ depending on PhD programs but usually include outstanding results at the bachelor's and master's levels. Successful candidates demonstrate competency through well-structured research proposals, strong performance in PhD interviews, and a clear interest in the research area. Publications, conference presentations, positive references, and teaching experience are not required, but they enhance the applicant's profile.
- ⊗ ***Where do I find PhD positions?*** PhD positions can be discovered through various channels. Universities, research institutions and laboratories often advertise PhD positions on their websites and academic job boards. Professional networks like *LinkedIn* and *ResearchGate* with departmental announcements serve as valuable resources. Subscribing to email lists and newsletters in the field of interest provides timely updates on new opportunities. Attending academic conferences and workshops also uncover open positions. University graduate school offices offer additional information.
- ⊗ ***What institute suits me?*** The choice of the institute, and within it the group, is pivotal for a successful PhD experience.

  The institute should be aligned with the applicant's academic background and interests. Consulting tutors and academics helps to understand the institution's reputation and research strength.
- ⊗ ***Which group suits me?*** Understanding the research group before enrolling in PhD is crucial. If possible, a visit to the research group should be arranged, to attend seminars, lab meetings, and social events, and to observe the group's atmosphere, interactions, and dynamics among members. Conversations with current PhD students, postdocs, and faculty allow gaining insights into their experiences and ongoing research projects. If a visit cannot be arranged, research group members can be approached by email to arrange an online meeting.

Research group sizes vary. Some are small, fostering close collaboration, while others are larger and more diverse. Applicants should consider their preference, whether they seek a tight-knit community or prefer a broader network.

⊗ ***Which topic suits me?*** Determining the right topic is essential for a fulfilling research journey. For the choice of the research topic, genuine interests should be prioritised, reflecting on modules the applicant enjoyed during their undergraduate or master's degree. The research questions should be original and feasible within a reasonable time frame. PhD topics based on third-party-funded projects often have predefined content and aims, while others might offer more topic flexibility.

⊗ ***How do I find a supervisor?*** In the case of advertised projects, direct communication with the academic lead responsible for the project is imperative. Conversely, prospective candidates should meticulously examine faculty profiles and actively participate in conferences to identify potential supervisors whose research interests align with their own. The subsequent step is crafting a brief email expressing interest and inquiring about supervision availability.

7.3.5.2 Application Process and Funding

Applying for a PhD involves nontrivial steps that depend on the targeted position. The entry requirements should be met, and funding options to support the studies should be explored. The application should be prepared and submitted according to the university's guidelines, ensuring all necessary documents are included.

⊗ ***What does the application process look like?*** Once a position is identified, it is important to read carefully all the instructions and requirements. First, a thorough check should ensure that the basic conditions are met. If they are, the required documentation should be gathered with enough time allocated, as preparing the documentation often involves obtaining documents from various student services, getting letters of recommendation from professors, or translating documents into a foreign language. Additionally, the required documentation usually includes writing a motivation letter, a detailed CV, and descriptions of previous projects worked on. All of this requires dedicated effort and time to prepare well.

⊗ ***What is important in the written application?*** The cover letter is paramount in the written application for a PhD study. This document provides an opportunity to elaborate on the qualifications, highlight relevant achievements, and articulate why the applicant is the most suitable candidate for the program. Diligent attention to spelling, grammar, and punctuation is essential, as these details significantly impact the overall professionalism and application clarity. A well-crafted cover letter effectively conveys academic and research competencies, demonstrating attention to detail and unwavering commitment to excellence.

⊗ ***What does the PhD application interview look like?*** The format of the PhD application interview varies but typically includes several key components. It often begins with discussing academic interests, background, goals, and proposed projects, in a formal or informal setting. Presenting a research proposal or demonstrating expertise in a specific area might be required. Additionally, a one-to-one discussion with the prospective supervisor is expected, allowing for a more in-depth conversation about the fit for the program. The interview process may include orientation activities such as visits to research spaces and networking opportunities with current students and faculty.

⊗ ***What funding possibilities are available?*** Funding possibilities for PhD studies vary widely. Full-time positions are typically geared towards international students, providing comprehensive support, whereas part-time positions cater to working professionals who wish to combine their careers with doctoral studies. Funding can come from positions aligned with specific research projects or state-funded positions, which government agencies or institutions finance. Additionally, scholarships are available to cover tuition fees and living costs, alleviating financial burdens. Self-funding, where the student independently covers their expenses, remains an option for those who do not secure funding.

□ ***Questions for a personal experience discussion***

- How did you find your PhD position?
- What did the application process look like?
- From which mistakes during your application process did you learn most?
- What advice would you give to potential PhD applicants?

7.3.6 Module 6: How to Handle Doubts and Problems Before and During the PhD?

Concerns and emotional issues commonly arise during PhD studies and can be difficult to deal with. When one starts a PhD, it is often the same period as building a career or starting a family, so a student considering a PhD might question whether it is the right path. These conflicting ambitions may overburden the candidate throughout the years needed to complete their doctorate. That is why problem recognition and seeking help in the right place before they become critical are key to properly overcoming issues on time.

7.3.6.1 Personal Doubts, Concerns and Burnout

Doing a PhD is, among other things, a challenge to the student's resilience. Beyond the scientific challenge per se, PhD candidates need to cope with the *"impostor syndrome"* [54] leading the candidate to doubt their readiness to start, continue, and

complete this professional and personal journey. Family challenges, mental health issues, financial constraints, and a work-life imbalance may all appear as the student progresses in their PhD studies.

- ⊗ ***Am I capable of pursuing a PhD?*** Doing a PhD is not as complicated as many candidates imagine. It requires research skills, intellectual capability, solid field knowledge, and resilience. Completing it successfully is possible if the student remains persistent and committed. For many PhD candidates, the *impostor syndrome* holds them back rather than the study itself. There will be challenges along the way, and the candidate must manage time and be disciplined in facing work and learning obligations. Some students only rely on their intellect. However, believing in yourself, possessing a strong work ethic, and having clear career goals are key to success.
- ⊗ ***Will I have enough innovative ideas?*** It is normal not to have (good) novel ideas at the first stage of the PhD process while the student gains expertise in the state of the art. Working under the supervision of a PhD mentor who shares the student's research interests can help formulate an innovative approach or solution. The candidate will also have many chances throughout their studies to refine their knowledge and understanding to reach their insights. That way, the student will create novelty in due time. A PhD process is a real-time learning and feedback loop so each step will inform the next. A PhD offers a huge potential for exploration and growth, professionally and personally.
- ⊗ ***What do I do if I am unsure or have problems during my doctorate studies?*** Doubts and problems are inevitable in the PhD process. The first step to facing these problems is to accept they will happen. If students are aware and mentally ready, their chances of facing the issue increase dramatically. There are mechanisms to help a struggling student, starting with mentorship. The first step is reaching out to the supervisor for help and guidance. Many universities have staff who help PhD students solve issues, such as counselling centres and financial aid programs. Academically, by attending conferences, training programs, and workshops, students may develop new skills and discover novel ideas or methods. This may inspire them if they feel stuck in their research or need to resolve the issues they encounter during their PhD journey. Lastly, taking good care of oneself through proper exercise and diet can also help the student stay focused and strong throughout the process.
- ⊗ ***Is doing a PhD compatible with family planning?*** Raising a family while pursuing a PhD is difficult but possible. Many universities have specific initiatives to support women PhD candidates in the process. The PhD supervisor can help. Flexible schedules, online meetings, and recorded lectures help tremendously to manage studies and family obligations. Childcare help and financial aid to support children also play their part, along with other on-campus child-friendly facilities. Time management and efficient planning will help complete all tasks academically and at home. This relies heavily on communication between spouses and the university staff and a supportive environment, which can help diffuse problems before they become bigger issues that may impact the studies.

- ***What do I do if I "run out of breath" during the doctorate?*** Everyone knows this feeling. A PhD takes years of continuous effort, and it is normal to have highs and lows during such a long period. Because of the current lifestyle, people are increasingly driven by quick rewards. Accepting that a PhD is a journey is the first step to remaining focused on the process. Time and task management skills are crucial—working on a schedule, planning effectively, and sticking to the plan allow the student to feel in control. Self-care practices such as physical exercise, mindfulness, being kind to yourself, eating and sleeping well throughout the years help, as does taking breaks when needed. Asking for help when overwhelmed by a task or a problem is a skill. If the problem is mental or emotional burnout, there are counselling services and support groups. A PhD retreat with other doctoral students can be one way to get out of a down period. In a retreat, the PhD students write, rest, and discuss each other's progress, allowing them to network, collaborate, and recover psychologically with people going through the same process.
- ***What are the typical concerns of students during their doctorate studies?*** Starting a PhD comes with many concerns because often candidates cannot access human or reference resources clearly explaining all the steps and details. Questions are on many different levels, starting with whether they can find a novel idea to research, to financial concerns throughout the PhD process, and whether they can build and maintain a good mentor-mentee relationship with a chosen supervisor. Writing the thesis and publishing articles in relevant, high-quality journals are other significant worries, along with academic milestones such as qualification exams, proposals, and thesis defence. Students are also anxious about job prospects during and after their studies. All these issues can lead to stress and burnout, so some students worry about how to take care of their well-being.
- ***Where can I find advice and support if I have problems?*** Depending on the problem, who the student can contact will differ. The PhD supervisor is nearly always the first contact point, but there are also dedicated offices or groups for various issues. Secondly, administrative and graduate offices make life easier for PhD students, from a Career Centre to help with networking and potential work to residence and visa offices to guide international candidates with relocation questions. There are mental health support centres to help with psychological issues and writing centres to aid with problems with academic tasks such as research.

7.3.6.2 Topic and Supervisor

During a PhD, difficulties might appear related to changing research topics and disruptions in communication with the supervisor. However, solving these problems is directly related to an open dialogue with and constant feedback from the supervisor.

⊗ ***Can I change, or adjust, my research focus during the PhD?*** Although researchers usually choose a topic at the beginning of their PhD program based on personal interests, previous experience, or discussions with potential supervisors, it is possible to change it later. Indeed, new aspects and problems may emerge, and the focus may change during the research process. In this case, consultation with the supervisor is crucial to get advice and feedback. In addition, collaborating with colleagues, participating in scientific seminars and conferences, and exploring interdisciplinary work can help change the research direction. However, it should be borne in mind that specific changes may affect research funding, as some grants are designed for particular areas.

⊗ ***What do I do if I am dissatisfied with my PhD supervision?*** To prevent such a situation, PhD students should always be proactive, i.e., take the initiative, seek feedback, and actively interact with their supervisor. However, in the case of such a problem, only open communication will allow a solution. Of course, it is necessary to understand the root causes of dissatisfaction and determine whether the problem is related to time, support, or appreciation. In this case, expectations, roles and responsibilities must be clarified, and the need for timely feedback, guidance, and emotional support must be communicated in an open dialogue with the supervisor. As a last resort, advice can be requested from faculty or graduate school. The experience of other PhD students who have faced similar problems can also be helpful.

7.3.6.3 Sexist Remarks and Sexual Harassment

As in many other areas of society, inappropriate comments and sexual harassment remain prevalent in STEM. A 2018 report in the US refers to up to 50% of women in faculty and from 20% to 50% of women students state they encountered or experienced sexually harassing conduct in academia [52]. There is, however, an increasing awareness of this problem. Institutions are adopting concrete measures to prevent misconduct and promote equity within scientific organisations (see, for instance, [18]).

⊗ ***Am I okay with being one of the few women in the group?*** The current enrolment rates of women in informatics degrees suggest women will remain far from achieving parity in informatics in the next years or even decades. This does not necessarily imply a toxic environment for women. The community is increasingly aware and concerned about this problem, and it typically considers sexual harassment and gender-based discrimination a code of conduct violation.

⊗ ***Where can I find help for sexual harassment?*** Higher education institutions have channels for reporting misconduct. These channels often have an anonymity mechanism to protect the person making allegations from possible retaliations against victims or whistle-blowers. These allegations are then analysed by an independent inquiry committee, which determines if the alleged misconduct infringes the code of conduct and, if so, initiates an investigation into the

allegations. Of course, false claims raised in bad faith are considered a serious offence [52]. Conferences and other scientific events typically also enforce codes of conduct. See, for instance, the policies from ACM [3] and IEEE [38].

⊗ ***How are the dignity and respect rights of PhD students applied at universities?*** Most higher education institutions have adopted codes of conduct and action plans to ensure gender equality. These aim to create a healthy space where all can thrive. The codes cover the behaviour of students, professors, and other staff and usually include recommendations on how to deal with any breaches of these policies.

□ ***Questions for a personal experience discussion***

- What obstacles/uncertainties did you face during your doctorate?
- Did you fear that you might not be smart enough for a PhD?
- How did you deal with any doubts you had?
- Who did you get support from?

7.3.7 Module 7: Considering a PhD Abroad?

Finding a proper PhD position may include considering applying for PhD studies abroad. Applying for a position abroad introduces different challenges, including the application process, administrative issues, financial issues, and differences compared to a PhD in a native country.

⊗ ***What distinguishes a doctorate abroad from a doctorate in my country?*** The differences between obtaining a doctorate abroad and in the home country can vary widely. Academic and institutional differences include the structure, duration, and specific requirements of doctoral programs. Practical issues, like tuition fees and living expenses, can also vary greatly. Some countries offer substantial scholarships, grants, or stipends for international students. One likely needs to navigate language barriers and adapt to a different culture, which can be challenging but enriching.

7.3.7.1 Finding a Position

When searching for the best-suited position, practical aspects such as required documentation, residence visa, language, and similar factors, can help to start narrowing down the list of countries and universities of interest.

⊗ ***How do I find doctoral positions abroad?*** Various academic job platforms and websites help in the search for doctoral positions abroad. Once potential universities according to the research interests have been identified, information can be gathered on the official websites of the universities and pages dedicated to research opportunities. Of course, participating in academic events

and presenting research results at international conferences can also help to establish new connections, communicate with professors and researchers, and find opportunities for PhD positions abroad. It also opens up opportunities for direct contact with professors whose research coincides with the personal interests of the PhD candidate. At the same time, the recruitment agencies' services can also be used to find PhD vacancies.

⊗ ***What to consider when applying for a doctorate abroad?*** One should consider the required documents, prerequisite tests, and communication with potential supervisors. It should be clarified whether a student visa is needed. It should be understood what the general process for applying to PhD programs abroad is, which usually requires an online application, academic transcripts, a CV including relevant experience, a statement of purpose, letters of recommendation, and language proficiency test results.

⊗ ***Can I ask doctoral candidates abroad for reports on their experiences?*** Communicating with doctoral students who have studied abroad can provide valuable information about the research environment, workload, funding opportunities, etc. Such connections can be organised through existing online platforms, academic forums, and social media groups. In addition, contact information about the research team representatives can be found on the official university websites. It is advisable to ask for some advice based on their experience by email or direct message.

7.3.7.2 Practical Issues

The practical concerns for a PhD may be broadly grouped into three categories: before, during, and after a PhD. Before starting a PhD, students must find the right country, program and supervisor. Communicating with the country, region or university officials may require time and energy. Knowing the local language or using translation services may also be necessary. Diplomas must be translated and notarised, often submitted via mail, requiring payment. Making travel arrangements, securing housing and healthcare, and other practical matters are all part of starting a PhD abroad. During the PhD, students must adapt to living in a new culture and being far from their family and friends. They establish themselves in the local culture, as the PhD process is lengthy. Academic and social expectations may also require some adjustment for the candidate. After the PhD, the student may struggle to stay in the country of study due to legal barriers or experience reverse culture shock when returning to their home country. The diploma recognition process is also reversed, this time for the foreign qualification to be recognised by the home state.

⊗ ***Do the requirements abroad differ from those in my country?*** Each country or region has unique requirements for accepting a PhD candidate. Some universities demand standardised tests during recruitment, while others focus on the candidate's research background. PhD program prerequisites may also vary, as some

universities recruit among undergraduate degree holders, whereas others only select potential candidates with master's degrees. Traditional PhD programs may last about 6 years and be more research-oriented, whereas newer programs are tighter and based more on coursework.

⊗ ***Do I have to speak the local language?*** Many international PhD programs are fully available in English. However, that is only one facet. Since a PhD involves living in a country for several years, it may be necessary to socialise or communicate often with locals who may not speak English, creating a language barrier. Personal and professional development may be difficult without understanding local customs and culture. As a PhD candidate, attending domestic conferences and scientific gatherings that require direct communication with local researchers may be hard. Without a translator, a candidate may be unable to broaden their networking opportunities and explore potential research collaborations.

⊗ ***How do I finance my stay abroad?*** A PhD may be financed in several ways. First, in some countries, a PhD position comes with a salary, and the candidate is a staff member and a student. Examples include Sweden, Germany, and Finland. Other countries, like the US or Canada, have available positions such as teaching assistants or part-time researchers. Hoping to attract bright young researchers, countries like China and Italy offer city or region-based grants and other benefits, such as family allowance. Institutes also provide project-based PhD positions. Many non-governmental organisations offer stipends, travel grants, incentives, and other financial awards to different groups, such as women of colour, students with specific needs, and more.

⊗ ***Where can I get advice if I want to go abroad?*** The best place for a PhD candidate to start is by asking for help from their professors, as these academicians know the student and have their networks. They can refer the student to a supervisor working in a university abroad who might be a good fit. Another source is the International Relations Office or Career Centre, as both offices have connections with other universities and can potentially recommend the student to a relevant program. The Erasmus+ Student Network, international study and exchange groups, international fairs, and summer programs are excellent for networking and gathering information.

⊗ ***What do I have to think about administratively?*** The key administrative requirements are properly translated and registered diplomas and certificates, a valid passport with enough time and pages to apply for visas and residence permits, and the appropriate health insurance. The candidate may be refused a visa or residence without ensuring these documents are in order, even if the PhD application is accepted.

Residency or a relevant visa is necessary for full-time study and financial support. Always verify specific eligibility criteria for each program. Many countries require proof of funds even when the student is offered a scholarship, and having the bare minimum in the bank statement may cause immigration officers to reject entry into the country. Proof of accommodation and a return ticket are required, so securing these before crossing the border into the host country is a good idea. Once in the country, internationals are expected to register

at the local police station for legal purposes. Registering at one's embassy is also well-advised.

7.3.7.3 After the PhD

A degree from a prestigious foreign institution can enhance the CV and open international career opportunities. However, the recognition of the degree may require additional steps.

⊗ ***Is the doctorate obtained abroad recognised in my country?*** The recognition of a doctorate obtained abroad varies depending on the country and the specific institution where the degree was earned. Some countries have bilateral agreements for mutual recognition of academic qualifications. Degrees from highly reputable and globally recognised institutions are more likely to be accepted internationally. The Ministry of Education or the equivalent authority in the home country for information on recognising foreign degrees should be contacted before enrolment in a specific PhD program.

□ ***Questions for a personal experience discussion***

- Where have you been abroad, how did you organise your stay, and who did you get support from?
- What skills did you learn?
- Looking back: what were the pros and cons of your stay abroad?
- How important was the stay abroad for your career?

7.3.8 Module 8: Wrap-Up Meeting

The final module is dedicated to wrapping up the program and gathering participants' feedback. Participants are encouraged to share their experiences and insights about the previous modules. Additionally, they are asked to provide suggestions for improvement, ensuring that future program iterations can be refined and enhanced based on their valuable input.

Similar to the first module, the discussion can be held by participants answering the questions orally or through an online form. However, for this session, it could be better to discuss after the participants have filled out the form, as that way there is written evidence that can be referred to when necessary.

□ ***Questions for a personal experience discussion***

- How would you rate your level of satisfaction with your participation in this program?
- Is there any question that remained unanswered, and if so, which one?
- What did you find the most interesting or useful in this program?
- How could the program be improved?

7.4 Impact of WoCa Lunch

The central goal of the WoCa Lunch is to help female students make informed decisions about their career paths beyond master studies. This central goal is connected to diverse implicit effects in different dimensions.

7.4.1 Long-Term Impact

In general, this program is expected to increase the presence of women in informatics, especially at the PhD level.

△ ***Increased number of female PhD students*** The program is designed to strengthen gifted female students, get their unfounded doubts out of the way, and motivate them to follow their scientific enthusiasm by enrolling in PhD studies. Thus the most obvious expected impact is increasing the number and percentage of female PhD students.

△ ***Improved success rate of female PhD students*** We stress that this program does *not* aim at convincing female students to go for a PhD. Instead, the objective is to inform them about the diverse aspects of PhD studies, and thus to support them to identify the career path which best fits their interests and abilities. Therefore, besides increasing the percentage of female PhD students, another expected impact is avoiding disappointments due to wrong expectations, thus reducing the dropout during PhD studies.

△ ***Awareness for women in informatics*** We expect an increased consciousness of Informatics/Computer Science departments for the needs of female students and the fact that gender-related differences need to be considered.

△ ***Further developing the program*** Last but not least, collecting experience from WoCa Lunch executions allows us to understand better the reasons, motivations and fears that influence the career planning of female students, which will in turn help to adapt and further improve the contents and form of the program.

7.4.2 Short-Term Impact

In contrast to the long-term impact on the overall evolution of the representation and role of women in informatics, the program's short-term impact is mostly on the participants as individuals.

△ ***Informed career decision of participants*** The program has been based on the answers of a carefully designed questionnaire, widely distributed in Europe. The evaluation of the answers helped us compose the program contents to cover all relevant topics, which were recognisable from the answers to lead

to uncertainties, wrong assumptions, doubts or fears. The perhaps most direct impact is to allow, by discussing those topics, for informed decisions of the participants regarding their career paths.

△ ***Network of women in informatics*** The program is expected in general to increase the self-awareness and the self-confidence of the participants and to strengthen the networking and the exchange between them. Besides the impact on the participating students, networks get strengthened beyond university boundaries, between the organisers and the invited interview partners.

7.4.3 Measuring Impact

The factors determining the evolution of the number of PhD students and the representation of women under them are manifold and diverse. Each execution of this program influences this evolution, and monitoring the number, percentage, and success rate of female PhD students hopefully will show positive tendencies. However, from the observation of complex effects, we cannot reliably draw any conclusion regarding the different factors of cause, thus the concrete impact of this program as a single factor is hard to measure quantitatively.

Whereas it is hard to determine and measure long-term impact, the short-term effects are somewhat easier to assess. The last module, the wrap-up meeting, offers a valuable opportunity to help the students reflect on their impressions, exchange their experiences, and get feedback about the immediate program's impact.

A short questionnaire, based e.g. on the questions listed in Sect. 7.3.8, can be designed for this purpose. Given that the program profits from a familiar atmosphere, the number of participants per execution should be relatively low: both paper and online evaluations are well-suited and do not require much effort to be processed. We can also collect direct feedback comments in the wrap-up session, in a live discussion (Fig. 7.2).

In addition, getting additional feedback a few semesters later allows us to maintain statistics about the further career paths of the participants.

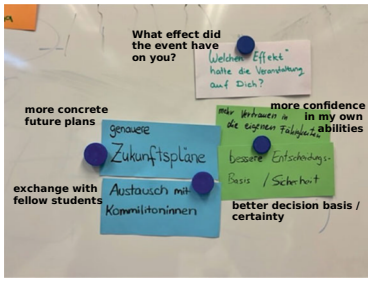

Fig. 7.2 Participants' feedback

7.5 Possible Adaptions to Different Environments

Considering diverse backgrounds, institutions, and cultural settings, joint lunches and discussions about the elements of PhD studies are not always feasible. For example, if students have varying commitments and do not have a standard lunch break, if there are not enough guest speakers or if there is a lack of support from the department, the program should be adapted to suit the local needs. The presented materials can be utilised in different ways.

- ***Program Timing*** The program is planned to last one hour every other week during lunchtime. However, the program can also be scheduled in the afternoon after lectures and other commitments, or at any time convenient to all the participants.
- ***Program Format*** The program consists of eight modules. If required, the number of modules can be reduced, or the program can be held as a full or half-day workshop, seminar, or simply as a two-hour lecture with discussion.
- ***Choosing the Right Modules*** Not all modules are equally applicable in every environment. For example, in countries with just a few universities or where students who go abroad do not return to their home country, modules related to finding positions and studying abroad might not be as relevant as other modules. Similarly, if the program is organised to motivate students to do the PhD at a given department, one might also want to skip these two modules. Additionally, modules related to academic and industrial careers can be combined. On the other hand, understanding what a PhD is and how to handle doubts and problems during the PhD always requires special attention.
- ***Participants*** The program can be adapted for different underrepresented minorities, considering their needs and problems. This means the module about personal doubts and obstacles should be carefully complemented, while other modules can mostly remain the same. Also, in some environments, the number of potential PhD students is too small to make it sensible to organise the program exclusively for women or any other underrepresented minority. In such environments, PhD students themselves are an underrepresented minority and should be given special encouragement and attention. The suggested questions do not have to be specially adapted when broadening the scope of participants.

⊙ Personal Experience Sharing: Two-Hour Workshop
The simplest form of the program was conducted at the Department of Computer Science, Faculty of Mathematics, University of Belgrade. It was organised as a two-hour workshop with all interested students. There were no guest speakers. During the workshop, the organiser showed slides containing all the questions by modules and then discussed the answers to the questions that interested the students the most. Six students attended the workshop, and

(continued)

all were very pleased with the opportunity to hear, understand, and discuss the topic of doctoral studies.

The interactive nature of the workshop allowed students to engage deeply with the material and receive tailored advice based on their specific concerns and interests. The success of this simple yet effective format highlights the importance of adaptability and demonstrates that, even with limited resources, we can create meaningful learning experiences. This format can serve as a model for other departments or institutions facing similar constraints, emphasising the value of personalised interaction and focused discussion.

7.6 Conclusions

In this chapter, we presented the WoCa Lunch program and reported on the first executions, demonstrating its positive impact. We described in detail answers to questions of interest. These answers can help teachers focus on the main issues that should be discussed during sessions if they decide to implement this program. Also, these answers can help students at universities where such a program is not implemented to understand the PhD process better, and its advantages and disadvantages. Students should also get ideas about important topics and answers they should seek further.

The program can be extended in different directions, depending on the participants' feedback after each program's execution. Additionally, one important direction is the development of supporting tools needed for program participation of individuals with special needs.

The next step is to unfold the program's main potential, which lies in its repeatability. The structured contents and the observations and recommendations presented here and under [2] allow execution with little effort and low cost. The authors would highly appreciate hearing back experience reports from further executions.

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