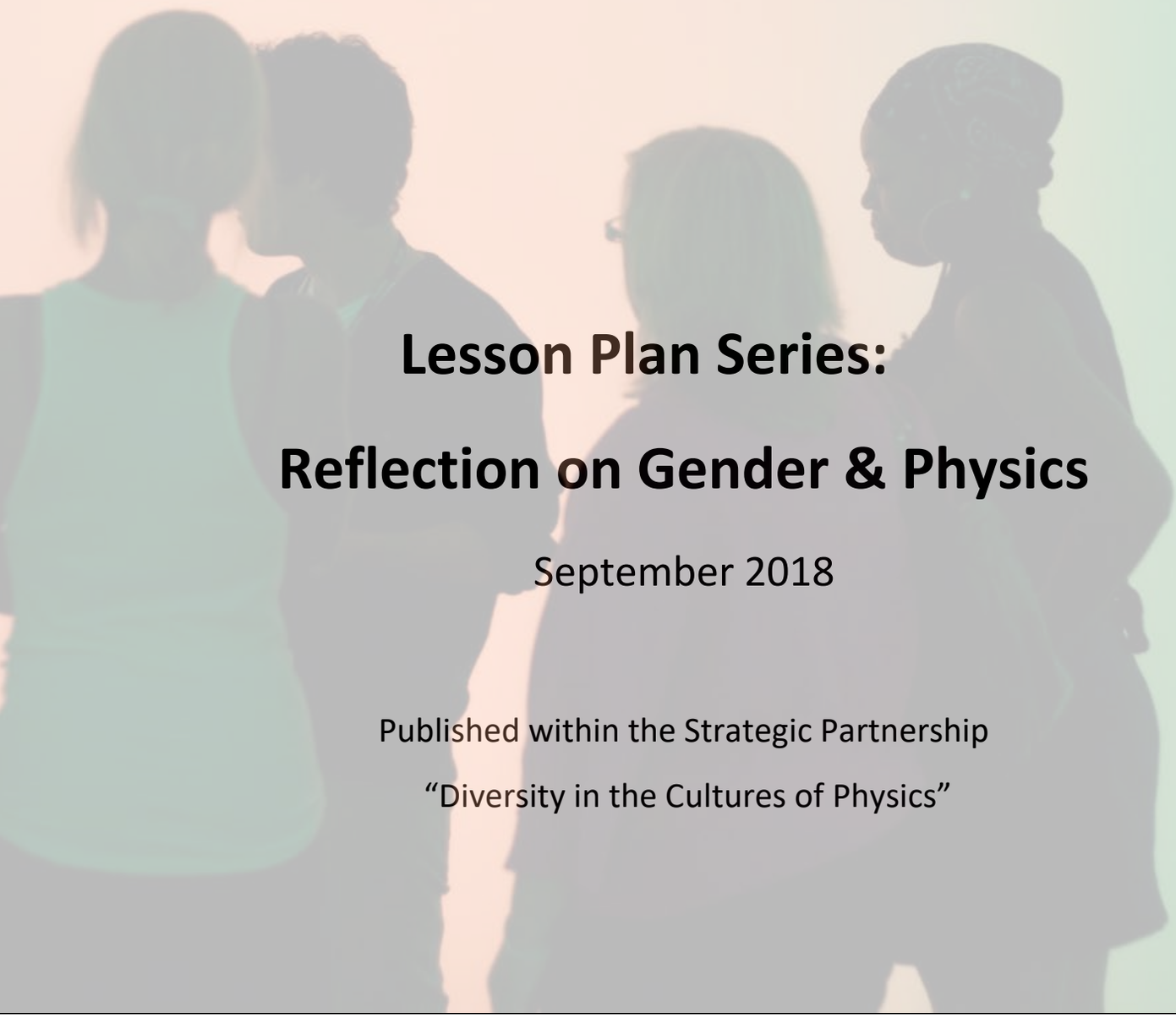
Elvira Scheich, Martina Erlemann, Leli Schiestl



Lesson Plan Series:

Reflection on Gender & Physics

September 2018

Published within the Strategic Partnership

“Diversity in the Cultures of Physics”

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The Strategic Partnership “Diversity in the Cultures of Physics” is an initiative seeking to build a transnational network for launching several key actions geared towards improving the gender balance in physics and its subfields. Until now the strategic partnerships consists of the following universities: Freie Universität Berlin, Universitat Autònoma de Barcelona, Universitat de Barcelona, University of Manchester, University of Sheffield and Uppsala Universitet . One of the partnership’s projects is an annual summer school series which formed the framework for the development of this Lesson Plans. The partnership is funded by DAAD/ Erasmus+ since 2016.

Published by Freie Universität Berlin in September 2018

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Dr. phil. Martina Erlemann is visiting professor for Gender in Mathematics and Natural Science at the Technische Universität Dresden. She is also affiliated to the physics department at Freie Universität Berlin. She graduated in physics and holds a PhD in sociology. Her research fields are Gender Studies of Science and Science and Technology Studies (STS).

Leli Schiestl is a graduated physicist. She has a broad expertise in projects to increase women’s and girls’ participation and visibility in different STEM-related contexts. She is the coordinator of the strategic partnership “Diversity in the Cultures of Physics”.

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Introduction to the Lesson Plan Series:

Reflections on Gender & Physics

In this volume we present a collection of 7 lesson plans to explore the gender imbalances in science and particularly in physics. The aim of these teaching units is to understand how gender inequalities are constructed and reproduced during the interactions in the labs and class rooms while doing physics. On the one hand, the students will learn to uncover the often unconscious processes which lead to underrepresentation of women in physics at all levels. On the other hand, the basic structural dynamics linking gender effects in science and society are taken into account.[1]

The lesson plans have been designed and tested as a part of the International Summer Schools "Diversity in the Cultures of Physics". This project is funded by DAAD / Erasmus+ since 2016, when a Strategic Partnership was formed to enhance the situation of female junior scientists. Scientists from the physics departments at Freie Universität Berlin, Universitat Autònoma de Barcelona, Universitat de Barcelona, the University of Manchester, the University of Sheffield and Uppsala Universitet joined this co-operation.[2]

Each lesson plan represents a teaching unit of 180 minutes that comprises discussion topics, references for reading materials and other resources, and interactive learning tasks.

Taken together, the lesson plans provide the material for a full course on gender & physics covering a set of key issues based on research in science studies. Parts of the lesson plans can be integrated in either general courses on interdisciplinary gender studies or specific courses on gender in STEM. Individual units can supplement social and natural science courses, that wish to point out specific gender dimensions in a reputedly gender neutral field of knowledge production. The resources can be used in classrooms from undergraduate level onwards.

Berlin, September 2018 Elvira Scheich, Martina Erlemann, Leli Schiestl

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[1] Resources that highlight the often forgotten historical contributions of women and minorities to the physical sciences are available on: https://www.aip.org/history-programs/physics-history/teaching-guides-women-minorities

[2] For information on this project, see: http://www.physik.fu-berlin.de/einrichtungen/ag/ag-scheich/projekte/diversity_in_the_cultures_of_physics/index.html

Lesson Plan 1 - Identifying and Breaking Stereotypes

Objectives

Participants will learn to identify gender stereotypes of physicists in public images of scientists and develop ideas how to break these stereotypes. Thereby they practice an analyzing view on public images of science.

Introductory Notes

Mass media have a crucial role in reinforcing stereotypes on how a typical scientist is or should be. These stereotypes are highly gendered, especially concerning (a) the competencies that are said to be essential for a successful career in science and (b) the occupational preferences men and women allegedly have.

Analyzing media coverage of science reveals asymmetrical ways in which male and female scientists are portrayed. Firstly, the underrepresentation of women scientists is reflected in the fact that female scientists are portrayed in the media less frequently than men. Furthermore, when portraying a female scientist, the woman's appearance and her exceptional status is commonly emphasized, not her research. Portraying female scientists this way is at risk of distracting from their scientific merits. In that way, women are used as "tokens" in media articles when being presented with strong emphasis placed on their role as wives and mothers. Thus the media foster people's sense of taken-for-granted normality concerning inequalities in science.

In the lesson an intervention by female science journalists, the Finkbeiner test, a so-to-speak No-Go-List for media portraits of female scientists to break gender stereotypes in journalism, is introduced and applied by the participants as an exercise for identifying stereotypes. This opens the possibility of thinking how to challenge stereotypes for the participants.

In-Class-Time

180-240 minutes, including 30 minutes break, depending on group size.
The break can be scheduled after the group work or can be split in 15 minutes before the group work allowing the session leader to copy articles and 15 minutes after the group work.

Schedule and Teaching Instructions

Homework for the participants in preparation for the session:

1. Search for and bring two mass media articles that portray physicists, one about a female physicist and one about a male physicist. These can be contemporary physicists as well as historical physicists. The media can be popular science magazines (e.g. Physics Today), news magazines, newspapers (e.g. New York Times) from any country.
2. Read the article of Chimba/Kitzinger (2010)

Introduction of the session:

15-20 minutes

As the session leader explain the background of the Finkbeiner test to the participants: The Finkbeiner test is a checklist proposed by journalist Christie Aschwanden to enable journalists avoiding gender bias in media articles about women in science. To pass the test, an article about a female scientist must not mention:

- That she is a woman
- Her husband's job
- Her child care arrangements
- How she nurtures her underlings
- How she was taken aback by the competitiveness in her field
- How she's such a role model for other women
- How she's the "first woman to..."

Christie Aschwanden formulated the test in an article in an online science magazine for women, *Double X Science*, on 5 March 2013. She did so in response to what she considered was a type of media coverage of women scientists that:

> "treats its subject's sex as her most defining detail. She's not just a great scientist, she's a woman! And if she's also a wife and a mother, those roles get emphasized too." (https://en.wikipedia.org/wiki/Finkbeiner_test, retrieved 01.09.2017)

Aschwanden named the test after the fellow journalist Ann Finkbeiner, who had written a story for her science blog *The Last Word on Nothing* about her decision not to write about the subject of her latest article, an astronomer, "as a woman".
In the aftermaths of publishing the test, some science articles, e.g. in the *New York Times* that were criticised by the audience have been revised.

Check if the participants brought articles as required. Ask them for their experiences when they have been searching for the articles.

If some participants report on having difficulties finding suitable articles, discuss with them why and ask for their hypotheses. Since there are fewer female than male physicists in research the chance to find a media portrait of a male physicist is much bigger.

Alternatively in case of too few sample articles: Let the groups analyze the article on Lisa Randall in The Guardian in 2005 (see Additional Resources)

Build groups. Groups should not be bigger than 4 people since they will have to analyze 8 articles at maximum.

Leader's preparation of group work / Participants' break:

15 minutes if needed

Copy the articles for all group members if needed.

Group Work:

60 minutes

Exercise on Work Sheet in Groups

Group Presentation, Part 1:

depending on number of groups, e.g. 60 minutes for 4 groups

Each group has 15 minutes to present their results for task number 1 and 2:

1. Let each group present the discussed articles, their test results, some citations from the articles as highlights,
2. Let each group present aspects of the discussion on gender differences between articles on men and woman physicists.

Break:

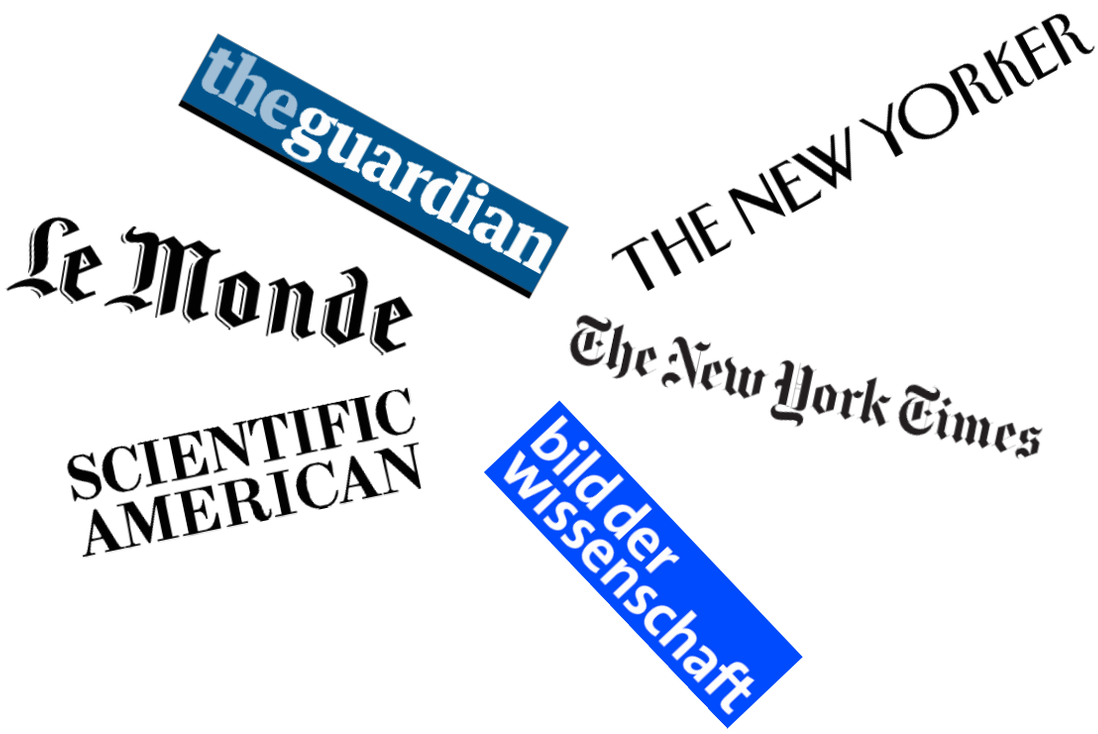
15 -30 minutes, depending on the chosen break schedule

Group Presentation, Part 2:

30 - 60 minutes

Plenary discussion of tasks number 3 and 4.
Participants might have different opinions on the Finkbeiner test. If so, let them discuss the pro's and con's of the No-Go-List.

Work Sheet: Identifying and Breaking Stereotypes



In the Finkbeiner Test there are listed several No-Gos when portraying females scientists.
It is a checklist proposed by journalist Christie Aschwanden in order to help journalists to avoid gender bias in media articles about women in science. To pass the test, an article about a female scientist must not mention:

- That she is a woman
- Her husband's job
- Her child care arrangements
- How she nurtures her underlings
- How she was taken aback by the competitiveness in her field
- How she's such a role model for other women
- How she's the "first woman to..."

1. Check if both articles on physicists that each of you brought for today would pass the Finkbeiner test. Which articles would pass the test? Which not? Prepare some highlights of the articles as result for the group presentation.

2. Are there differences between the articles portraying the male and the female physicist concerning their test result? Discuss the differences and prepare the results of the discussion for presentation.

3. If there are several articles that fail the test, how could they be improved? Any ideas?

4. Discuss how stereotyped representations of scientists in the media can be overcome?

Obligatory Reading

Chimba, Mwenya; Kitzinger, Jenny (2010): Bimbo or boffin? Women in science: an analysis of media representations and how female scientists negotiate cultural contradictions. In: *Public Understanding of Science* 19 (5): 609-624.

Further Reading

Code, Lorraine (2006): Images of Expertise. Women, Science, and the Politics of Representation. In: Ann B. Shteir, Bernard Lightman (ed.): *Figuring it out. Science, Gender, and Visual Culture*. Dartmouth College Presse, Hanover / London: 289-314.

Elena, Alberto (1997): Skirts in the Lab: "Madame Curie" and the Image of the Woman Scientist in the Feature Film. In: *Public Understanding of Science* 6: 269-278.

Erlemann, Martina (2013): Hunting for female galaxies and giving birth to satellites: the gendering of epistemic cultures in public discourse on physics and astronomy. In: *Transforming Substance: Gender in Material Sciences – An Anthology*. Helene Götschel (ed.). Centre for Gender Research, Uppsala University: 29-56.

Flicker, Eva (2003): Between brains and breasts — women scientists in fiction film: on the marginalization and sexualization of scientific competence. In: *Public Understanding of Science* 12: 307-318.

Kitzinger, Jenny; Chimba, Mwenya; Williams, Andrew; Haran, Joan et al. (2008): *Gender, Stereotypes and Expertise in the Press: How Newspapers represent female and male Scientists.* Cardiff University. Report of the UK Resource Centre for Women in Science, Engineering and Technology (UKRC).

Kitzinger, Jenny; Haran, Joan; Chimba, Mwenya; Boyce, Tammy (2008): *Role models in the media: an exploration of the views and experiences of women in science, engineering and technology.* Cardiff University. Report of the UK Resource Centre for Women in Science, Engineering and Technology (UKRC).

LaFollette, Marcel C (1988): Eyes on the Stars: Images of Women Scientists in Popular Magazines. In: *Science, Technology & Human Values*: 262-279.

LaFollette, M. C. (1990). Making Science our own – Public Images of Science 1910-1950. Chicago: University of Chicago Press.

Long, Marilee et al. (2010): Portrayals of Male and Female Scientists in Television Programs Popular Among Middle School–Age Children. In: *Science Communication* 32(3): 356-382.

Steinke, Jocelyn (1999): Women Scientist Role Models on Screen. A Case Study of "Contact" In: *Science Communication* 21: 111-136.

Steinke, Jocelyn (2005): Cultural Representations of Gender and Science. Portrayals of Female Scientists and Engineers in Popular Films. In: *Science Communication* 27: 27-63.

Additional Resources and Materials

- Website of the Finkbeiner Test: https://en.wikipedia.org/wiki/Finkbeiner_test
- Website of the science journalist Ann Finkbeiner: http://annfinkbeiner.com/
- Finkbeiner's Blog *The Last Word on Nothing*: http://www.lastwordonnothing.com/
- Website of science journalist Christie Aschwanden: https://christieaschwanden.com/
- Article on Lisa Randall in *The Guardian* in 2005: http://randall.physics.harvard.edu/RandallCV/Guardian_06_05.pdf
- *Ask her more*, Project against stereotypical representations of women in film industry and sports http://therepresentationproject.org/the-movement/askhermore/

Lesson Plan 2 - Dis/Encouragements in becoming a Physicist

Objectives

Participants will learn to reflect about their own biography and the decision making process on their occupation during childhood and adolescence. They will be enabled to get aware about possible encouraging and discouraging factors when deciding for their professional aim to become a physicist. Furthermore, they will get an impression how categories of gender, race, class and others can have hindering effects in pursuing their occupational aim respectively that some persons are privileged compared to others.

Introductory Notes

When getting interested in scientific fields or thinking of becoming a scientist, women and men can be influenced by a number of factors that have either encouraging or discouraging effects on the decision making process. Many of these push- and draw-back-factors are gendered: Men and women are ascribed to have different interests and aptitudes, competencies and abilities that are said to be typical for their gender. Young people can be confronted with these cultural stereotypes about men and women in the family, in school, by media, by their peer group and in other contexts.

Many studies that are based on Draw-a-scientist-tests (DAST) show that these cultural stereotypes run contrary to young women's motivations to become a scientist so that they can feel discouraged to decide for a career in science. However, individual teachers, parents, relatives, friends or others can also have a supportive influence and work as counter-stereotype, e.g. as role model. Further factors that can have an effect on a decision to begin a career in science are living conditions, key experiences and others.

Beyond gender stereotypes which can hinder in particular girls and young women to decide for science, also other categories of social inequality like race, class and others can discourage or even hinder young people's decision for science or, later on, slow down their career in science.

In the lesson the aim is twofold: Getting aware of the impact of categories like race and class on the chance to be supported in pursuing a career in science and, secondly, push- und draw-back-factors of family, friends, teachers, colleagues and other influential persons in the individual biography.

In the first part the **Privilege Walk** is centre stage. It is an intervention activity, based on the idea of Peggy McIntosh (1990), in order to let students get aware of privileges, in particular regarding race, and their importance for the everyday life of individuals. It is designed in a way that the interplay between norms and diverse background of participants will become visible in any given

context. For the context of academic careers it has been developed by Staffan Andersson (2014). He explains:

> "In higher education […] norms, values and expectations affect what is being recognized and accepted. The interplay with such cultural systems can have a critical influence on how people behave and succeed. […] In this exercise all students are standing side by side at the beginning. Different statements are read, […] the students react upon these statements by moving backwards and forwards. The diversity in the group becomes apparent in a very visual, and often emotional, way as students react in different ways and thereby move apart." (Andersson 2014).

In this session's version of the Privilege Walk the participants will take over the role of fictive personas of a physics community. These personas that are sketched on cards will be handed out to participants in advance so that they will do the Privilege Walk as the fictive persona. This is in order to get a wider diversity among the group which is important especially for groups that are rather homogeneously with respect to gender, race, age etc.

In the second part of the session an exercise on **Learning Biographies** stands centre stage. The aim is to recapitulate the decision process for a career in physics and its push- und draw-back-factors. The design of the activity is based on the model of learning biographies (Gudjons, Wagener-Gudjons, Pieper 2008).

In-Class-Time

240 minutes, including 30 minutes break.
Can be split in two sessions between Privilege Walk and Learning Biographies

Schedule and Teaching Instructions

Preparation for the session:
Prepare **persona cards** for the participants. Depending on the size of the group, you can have more than one card for each persona to be distributed in the sample since people might interpret the privileges of their persona differently.
Some examples of personas of a physics department community are (examples drawn from Andersson 2016):

> *You are a male senior lecturer in your thirties. You grew up, studied and struggled yourself to a PhD in a neighbouring country. You come from a working class home, and had little contact with your family even before moving abroad. You think you have adapted rather well le the culture of your present country of residence and your colleagues.*

You are a female senior lecturer in your thirties. You are unmarried and pregnant with your first child. You have had some problems with the pregnancy, and are not recommended to exert yourself physically. Your name and appearance indicate that you are of Asian descent.

You are a female: post doc in your thirties, working in a foreign European country. You have a hearing problem. Which has not bothered you very much, but it is a little more of a problem now that you are in a foreign-language environment. You rarely take part in informal gatherings. People are nice to you, but you don't share their interests or their sense or humour.

Prepare the **statements** for the walk. The statements should be formulated and chosen according to the focus of a physics department community.
Some examples for the context of natural sciences are (examples drawn from Andersson 2016):

You rarely, if ever, experience being seen as a representative of a gender group.
You have never been told that science is not for you.
You feel that you belong to the department.
You rarely worry about the continuation of your employment.
Portraits and pictures at the department mostly portray people like you.
You can easily go to interesting conferences on short notice.
You have never experienced a joke that offended you at the department.
You never feel unsafe at the department, on the campus or on your way home when you have been working late at night.
You feel that your students respect you.
You have never been told that "you don't really rook like a scientist".
You have never had concerns about being sexually harassed.

Homework for the participants in preparation for the session:

- Read the article of Ong (2005)

Privilege Walk:

60 minutes

1) Hand out persona cards which have been prepared before the class.
2) Participants read their descriptions and reflect upon their persona for roughly 5 minutes.
3) The proper exercise starts with all participants standing side by side about an arm's length apart, leaving space in front and behind at one side of the room.
4) Explain to them that a number of statements will be read.
5) They should take one step forward if they feel their persona agrees with the statement or the is appropriate for their persona. Everyone else who feels this statement does not hold for her persona will stand still. Each step should be an average length step.

6) Read all the statements one at a time allowing time for participants to take a step.

During the concluding part of the exercise when all the statements have been read, let the participants reflect upon results and discuss what happened. This can initially be done standing in the "landscape" resulting from the walk, but can later continue in a group format.

Some examples of reflection questions (cf. partly Andersson 2016):

- What are your thoughts on what has happened here?
- Why do you think this happened?
- How did it feel to remain standing while others walked ahead?
- How did it feel to walk ahead when others were left behind?
- Why did you end up here?
- What did you attribute to your persona?
- What could have helped your persona to take more steps forward? Think of the strategies of the women of colour that Ong describes in her article.
- What factors affect who proceeds in their academic career?
- Which are the underlying norms that affect academic careers?
- How do these affect the possibilities of different academic staff?

Participants' break:

15 minutes

Group Work:

60 minutes

Build groups. Groups should not be bigger than 4 people.
Exercise on Work Sheet in groups
The tasks are threefold:

1) Participants should reflect their biography concerning their decision process to become a physicist on their own on a sheet of paper.
2) They should exchange their results within their group.
3) They should discuss and evaluate their experiences in the light of their biography so far. The leading question for this exercise is: Would I have decided differently today?

Participants' Break:

15 minutes

In preparation of the group presentation the leader draws all the bubbles on blackboard or flipchart.

Group Presentation:

90 minutes, depending on number of groups

Let each group present their results of push- und draw-back-factors as + or – signs in the respective bubbles via oral presentation at the blackboard/flipchart and let them present the results of their discussion (result of task 1 and 2, each for 15 minutes)

When all groups have presented, discuss the resulted + or – signs for each bubbles.

Discuss possible created new bubbles.

Have a plenary discussion of the discussion question of task 3.

Work Sheet: Dis/Encouragements in becoming a physicist

1) Remember the time when you made your **first decision** concerning your future/current profession or education. Write down next to the circles, what **influence on the decision-making process** you can think of relating to each area. If you feel, that something important is missing, you have a free circle available to use. Then draw arrows from the circles toward the mid - to your profession or education. Through the thickness of the arrows you can show how important the different areas of your decision were. Note with a + or – sign if the influences were supportive or had a rather drawing back effect on your decision process.

2) Compare the results in your group and collect push- and draw-back-factors.
   Can you identify the impact of stereotypes of gender and of stereotypes of science?

3) Discuss the following questions:
   - Today, if I were in the same decision-making process again, how would I decide?
   - If I had been given the choice again, would I decide in the same way?
   - What do I like about my profession or education?
   - After making a decision on my education, how did my professional career proceed? Which influences were decisive?
   - How is my professional career supposed to go on? On what factors depends this professional progression?
   - If I come across stereotypes of gender and/or science, how do I reply to them? Exchange your experiences.


School teachers
?
Family Tradition: My parents wanted me to be …
Friends, Class Mates, Neighbourhood Children
Becoming a Physicist
Childhood Ambition: As a child I wanted to be …
Living Conditions that hindered or promoted me …
My Hero/ine Role Model: I always wanted to be like …
Prohibited Careers I was not allowed to be a …

Obligatory Reading

Maria Ong (2005): Body Projects of Young Women of Color in Physics: Intersections of Gender, Race, and Science. In: *Social Problems* 52 (4): 593-617.

Further Reading

Chambers, David (1983): Stereotypic Images of the Scientist: The Draw-a-Scientist Test. In: *Science Education* 67: 255-265.

Cheryan, Sapna (2012): Understanding the Paradox in Math-Related Fields: Why Do Some Gender Gaps Remain While Others Do Not? In: *Sex Roles* 66: 184–190

Shapiro, Jenessa; Williams, Amy (2012): The Role of Stereotype Threats in Undermining Girls' and Women's Performance and Interest in STEM Fields. In: *Sex Roles* 66: 175-183.

Steinke, Jocelyn et al. (2007): Assessing Media Influences on Middle School–Aged Children's Perceptions of Women in Science Using the Draw-A-Scientist Test (DAST). In: *Science Communication* 29 (1): 35-64.

Additional Resources and Materials

Andersson, Staffan (2014): *Privilege walk - A path towards understanding norms and stereotypes*. Abstract for the ICED 2014 -conference "Educational development in a changing world".

Andersson, Staffan (2016): *Privilege walk – A path towards understanding norms and stereotypes*. Unpublished manuscript for the Berlin – Uppsala Summer School "Diversity in the Cultures of Physics".

Gudjons, Herbert; Wagener-Gudjons, Birgit; Pieper, Marianne (2008): *Auf meinen Spuren. Übungen zur Biografiearbeit*. Julius Klinkhardt, Bad Heilbrunn.

McIntosh, Peggy (1990): *White privilege: Unpacking the invisible knapsack*. Independent School, 49(2): 31-36.

Lesson Plan 3 - Doing and Undoing Bias in Academia

Objectives

The participants will learn to identify distinct patterns of gender bias in academia and to get ideas how to react and interact when being affected by gender biases in daily academic interaction. Possible survival strategies are offered so that participants can apply and adapt them for their personal career and action strategies within academia.

Introductory Notes

Gender biased interaction in academia is a severe problem that affects the careers of women negatively in a way that it can slow down the career and even strongly damage it. Therefore it is important to enable women to be aware of possible gender biases being "at work" in academia so that they can identify gender biases and develop survival strategies against them.
Gender biased interaction can be overt sexism, but also subtle stereotyped misconceptions about women scientists that are grounded in implicit but pervasive cultural stereotypes that portray women as less competent but simultaneously emphasize their alleged female stereotyped features. Subtle gender biases that are based on these stereotypes are exhibited in principle by both men and women (cf. Moss-Racusin 2010).

Central for this session is the websites platform "The Gender Bias Learning Project" that was developed within the Center for WorkLife Law at UC Hastings College of the Law. The platform offers a gender bias training in order to enable women to act and react when being confronted with gender biased interaction. The training provides examples of possible forms of reactions in a way
(a) that the bias become apparent and visible for the persons involved in the interaction
(b) that the career at long term is not at risk to be damaged due to gender bias patterns.

The website shows 4 different patterns of gender biases that are illustrated by a series of animated video scenarios. Additionally the training provides survival strategies for handling each type of bias that is presented and discussed in video clips from interviews with gender bias experts.

Gender bias is explained as being not stemming:

> *from malevolence, but from the perceived mismatch between the "typical woman" and the requirements of jobs that historically were held by men such as professor, scientist, and investment banker. […] Gender bias takes many forms, some obvious and others subtle (http://www.genderbiasbingo.com/gender-bias/, retrieved 05.09.2017).*

Examples are:

- *Objective rules applied rigidly to women but leniently to men*
- *The persistent assumption that a mother is home with her children when she is at a committee meeting, presenting at a conference, or home writing her book*
- *An atmosphere where women are accepted only if they cater to the comfort levels of men who expect them to play traditionally feminine roles (http://www.genderbiasbingo.com/gender-bias/, retrieved 05.09.2017)*

In-Class-Time

150-180 minutes, depending on length of the group work time slot, including 30 minutes break

Schedule and Teaching Instructions

Preparation for the session:
Be sure that the participants have at least 4 computer at their disposal and that there is internet access.

Homework for the participants in preparation for the session:

- Read the article of Moss-Racusin (2012)
- Bring a computer, tablet or the like

Group Work:

60–75 minutes

Explain briefly the "The Gender Bias Learning Project". Build 4 groups and make sure that in every group there is computer with internet access so that the participants can watch the videos.
Distribute the group work sheet.
Exercise on Work Sheet in groups.

Participants' Break:

30 minutes

Group Presentation:

60-75 minutes

Each group has 15 minutes including questions for understanding of the other groups.
In the presentation the groups should

1) Sum up the bias mechanism showed in the videos for the others.
2) Present results of the discussion on survival strategies. Present new ideas or situations they have come across.

Work Sheet: Doing and Undoing Bias in Academia

Form 4 groups and watch the video clips with the respective 3 scenarios together.
Each group will work on one pattern.

Group 1: Prove it Again!
http://www.genderbiasbingo.com/prove-it-again/#.WX7wlXpjK6U

Group 2: The Double Bind
http://www.genderbiasbingo.com/double-bind/#.WX70UnpjK6U

Group 3: The Maternal Wall
http://www.genderbiasbingo.com/maternal-wall/#.WX7zNnpjK6U

Group 4: Gender Wars
http://www.genderbiasbingo.com/gender-wars/#.WX71A3pjK6V

After having watched the films exchange and discuss:

- Have you experienced or observed this kind of bias at your university?

Have a look at the expert videos on Survival Strategies for your respective pattern:
http://www.genderbiasbingo.com/prove-it-again/#.WX7wlXpjK6U

- Which of these suggestions suits you?

Prepare a short summary of your ideas for the plenary discussion. If possible, use an example from your own. You can also play a sketch.

Obligatory Reading

Moss-Racusin, Corinne et al. (2012): Science faculty's subtle gender biases favor male students. In: *Proceedings of the National Academy of Sciences* 109 (41): 16474-16479.

Further Reading

Ecklund, Elaine Howard; Lincoln, Anne E.; Tansey, Cassandra (2012): Gender Segregation in Elite Academic Science. In: *Gender & Society* 26: 693-717.

Etzkowitz, Henry et al. (1994): Barriers to Women in Science and Engineering, In: *Who Will Do Science? Educating the Next Generation*. Willie Pearson Jr., Irwin Fechter (eds.), Baltimore: Johns Hopkins University Press: 43-67.

Roos, Patricia A.; Gatta, Mary L. (2009): Gender (in)equity in the academy: Subtle mechanisms and the production of inequality. In: *Research in Social Stratification and Mobility* 27 (2009) 177–200.

Zuckerman, Harriet, Cole, Jonathan, Bruer (1991): The outer circle. Women in the Scientific Community.

Additional Resources and Materials

The Gender Bias Learning Project: http://www.genderbiasbingo.com/

Lesson Plan 4 - Networking against Structural Inequalities

Objectives

The participants will learn about the institutionalization of gender equality policy in universities as they visit the gender equality officer of their university or research institution. They will get informed about the status and position of the gender equality officer and its legal background, especially concerning recruitment processes in academia, the gender equality actions of the organization and the offerings for women scientists in the organisation. Furthermore, they will get acquainted with the importance of networking, get to know different networks of women scientists and learn about structural gender inequalities in science.

Introductory Notes

In this session the focus will be on structural gender inequalities the individual is rather powerless against and that cannot be resolved with individual interaction strategies. As an example of structural inequalities the gender bias of the peer review system is introduced and discussed.
Networking, formal and informal, as a strategy against structural gender biases is the focus of the lesson. Different networks for women scientists are introduced.
In the first part of the lesson a meeting with or visit of the gender equality officer is scheduled. The meeting with the equality officer will be flanked with tasks for the participants to actively intervene in the talk with the equality officer. The participants will be handed out cards describing situations where an equality officer might help or have some useful information. In order to avoid a pure frontal setting during the visit, participants will have to empathize with fictive personas and will have to address to the equality officer and ask for advice. The aim is to give an overview what kinds of supports or information an equality officer can offer.
In the second part the participants discuss a study on the gender biased peer review system, in the exemplary study on the Swedish Medical Council and their evaluation practices of research proposals of medicine.

In-Class-Time

240 minutes, including 30 minutes break.
Preparation of the lesson will take more time in advance since a meeting with an external person, the gender equality officer, is to be organized.

Schedule and Teaching Instructions

Preparation for the session:
Contacting the gender equality officer and organize a meeting with the group or a visit of the group in his/her office. The design of the meeting will differ depending if you visit the departmental gender equality officer or the person in charge for the whole university/organization. Meeting the departmental gender equality officer allows you to focus more on existing funding opportunities for physics, on special networks of women physicists and other specifities of the physics community.
Make sure that the gender equality officer knows about the intervening situation cards the participants will be handed out.
Preparing situation cards to hand out to the participants.

Examples of cards can be:

> *Imagine you are in the following situation: As a PostDoc researcher you want to continue your research at a university abroad. You do not know how to get some funding for it, if your partner and your little 2-year-old child can accompany you.*
>
> *Imagine you are in the following situation: You want to have some solid arguments when discussing with your male colleagues if women are discriminated in appointment procedures or if there simple are not enough women physicists interested and competent enough to hold a professorship in physics.*
>
> *Imagine you are in the following situation: You want to apply for an open position at the physics department but you do not have any details on the physics department, except the information you get from its website. You would like to know something about the climate in the department, is it chilly against women or rather open-minded.*

Cards should cover topics like:

- gender equality in application procedures
- women's professional networks and how to find them
- child care options at university
- data on women in science/physics
- informal networks, how to get top know other women in the department

Homework for the participants in preparation for the session:

- Read the article of Wennerås/Wold (1997)

Introduction and preparation for the meeting:

15 minutes

Hand out situation cards with question to ask the equality officer. Not every one needs a card. They can build groups of two persons.
State that they will have to think about what they would ask the equality officer in order to solve their problem described on the situation cards.

Meeting the equality officer:

90-100 minutes

Visit of or meeting with the equality officer. As design for the visit you can choose an input with subsequent question round or a panel where you talk with the equality officer about his/her work in a more conversational mode. Then, for the intervention of the participants, hold one chair free. Explain to them before that they can take a seat on the chair when they feel it is time to bring in their situation card problem.

Participants' Break:

30 minutes

Group Work:

45 minutes

Building groups. Groups should not be bigger than 4 people.
Exercise on Work Sheet in Groups.
Depending on the country you teach this lesson you can think of replacing the logos on the worksheet with those of the women's networks of your own country.

Group Presentation:

45 minutes

Plenary discussion on the questions raised on the work sheet

Work Sheet: Networking against structural inequalities

Rethink the findings of Wennerås/Wold regarding:

- Measuring productivity of a scientist. Is it an appropriate measure? What is your opinion?
- Factors influencing the scores in review?
- Is the peer review system, exercised this way, adequate in order to find out which proposals merit realisation?
- Suggestions for change?

Having listened to the talk of the gender equality officer, discuss:

- Can gender equality policy do anything against such kinds of structural inequalities?
- Can women's networks take action against such inequalities? Do you have ideas?

- Do you know the logos above and something about the organisation's activities?

Obligatory Reading

Wennerås, Christine; Wold, Agnes (1997): Nepotism and sexism in peer-review. In: *Nature* 387 (22 May): 341-343.

Further Reading

On structural inequalities:
Fox, Mary Frank (1995): Women and scientific careers. In: *Handbook of Science and Technology Studies.* Sheila Jasanoff et al. (eds.). Sage, Thousand Oaks: 205-223.

Shen, Helen (2013): Mind the Gender Gap. In: *Nature* 495 (7. March 2013): 22-24.

Sonnert, Gerhard; Holton, Gerald (1996): *Who succeeds in Science? The Gender Dimension*. Rutgers University Press, New Brunswick.

Van den Brink, Marieke (2011): Scouting for talent: Appointment practices of women professors in academic medicine. In: *Social Science & Medicine* 72: 2033-2040.

On Networking:
Murillo, Luis Felipe R et al. (2012): Partial Perspectives in Astronomy: Gender, Ethnicity, Nationality and Meshworks in Building Images of the Universe and Social Worlds. In: *Interdisciplinary Science Reviews* 37 (1, March): 36–50.

On Gender Equality policy in Physics:
Rolin, Kristina; Vainio, Jenny (2011): Gender in Academia in Finland: Tensions between Policies and Gendering Processes in Physics Departments. In: Science Studies 24 (1): 26-46.

Additional Resources and Materials

- Working Group Equal Opportunities of the German Physical Society: https://www.dpg-physik.de/dpg/gliederung/ak/akc/index.html (retrieved 06.09.2017)
- WG 5 Women in Physics of IUPAP: http://iupap.org/working-groups/wg5-women-in-physics/ (retrieved 06.09.2017)

Lesson Plan 5 - Career Stages and their Shifting Challenges

Objectives

The participants learn about different career stages in physics and the different implicit norms the members of the community are supposed to conform to in order to be accepted as belonging to the physics community. This will be described and analyzed for the field of high energy physics. The participants learn that these norms are highly gendered in a way that women are implicitly excluded.

Introductory Notes

Sharon Traweek (1988) offered with the groundbreaking ethnography of the high energy physics community in the U.S. “Beamtimes and Lifetimes” detailed insights on the different stages of a career in high energy physics, their implicit norms that have to be fulfilled so as on their specific anxieties and fear for failure in each career phase. It is shown inasmuch these anxieties and norms are gendered in a way that women are not supposed to build careers in high energy physics.
Since the ethnography has been published end of the 80ies participants might be interested in the question if these specifics might have changed to the present. So it might be useful to combine the work on the text of Traweek with excerpts from a talk of Jocelyn Bell Burnell at CERN in 2013.

In-Class-Time

150 minutes, including 30 minutes break.
The session can be combined with contents of Lesson Plan 6 on Interaction patterns in the Lab. In this case begin with the film screening and its group work and let follow the group work on the text of Traweek.

Schedule and Teaching Instructions

Homework for the participants in preparation for the session:

- Read the article of Traweek (1988)

Group Work:

60 minutes

Building 4 groups. Exercise on Work Sheet in Groups

Participants' Break:

30 minutes

Plenary Discussion:

60 minutes

Let each group present one career stage and then discuss.

In case that you combine this lesson with lesson number 6, include question number 2 for the plenary discussion.

Work Sheet: Career Stages and their shifting Challenges

Rethink the text of Traweek (1988) you have read for today.
Think about the worries, insecurities and anxieties that Sharon Traweek describes for the different career stages of high-energy physicists.

Construct a table with the following fields and think it over inasmuch gender is relevant here:

Career Stage	***Anxieties***	***Implicit Norms***
Undergraduate students		
Graduate students		
PostDocs, research associates		
Group Leader, fully-fledged physicists		
Senior physicists, “statesmen of physics”		

Discuss and prepare for the plenary discussion:

1. What is your opinion? Are these worries unavoidable or can you imagine a science system where these anxieties are not so inevitable? How, then, would science be like?

[in case of combination with lesson 6]:
After the film screening of “Naturally obsessed” rethink:

2. Are there connections between the thoughts and worries of Rob, Gabe and Kil in the film and those of the doctoral students and PostDocs of physics as Traweek describes them?

Obligatory Reading

Traweek, Sharon (1988): *Beamtimes and Lifetimes. The World of High Energy Physicist.* Harvard University Press: Cambridge MA. Chapter 3, p. 74-105.

Further Reading

Gaspani, Fabio (2014): Gendered Organizations. The Case of Italian Astrophysics. In: *Multidisciplinary Journal of Gender Studies* 3(3): 483-504.

Keller, Evelyn Fox (1977): The Anomaly of a Women in Physics In: *Working it out: 23 Women Writers, Artists, Scientists and Scholars talk about their Lives and Work*. Sara Ruddick, Pamela Danlies (eds.). Pantheon Books, New York: 77-91.

Traweek, Sharon (1992): Border Crossings: Narrative Structures in Science Studies and among Physicists in Tsukuba Science City, Japan. In: *Science as Practise and Culture*. Andrew Pickering (ed.). University of Chicago Press, Chicago: 429-465.

Additional Resources and Materials

About SLAC to date: https://www6.slac.stanford.edu/

About KEK, a high energy physics facility in Japan: https://www.kek.jp/en/index.html

About CERN: https://home.cern/

Lecture by Jocelyn Bell Burnell: https://www.youtube.com/watch?v=jp7amRdr30Y

Interview with Evelyn Fox Keller: http://www.cbc.ca/radio/ideas/how-to-think-about-science-part-14-1.464990

Lecture of Jocelyn Bell Burnell at CERN: http://cds.cern.ch/record/1625808

Lesson Plan 6 - Prevailing Interaction Patterns in the Lab

Objectives

Participants get an impression of what daily life of PhD students in a laboratory is like and get insights on how the relationship and interaction between mentor and PhD-student can look like and also how diverse this relationship can be. They will get a glimpse of how these relationships can play out differently for women and men and how decisive this can be for finalizing a PhD or for staying in scientific research in principle. Furthermore, they will get aware of the fact that also science documentaries are subject to narratives and story-telling and are a kind of constructed representation of scientific success story.

Introductory Notes

The documentary film, “Naturally Obsessed; the making of a scientist” compresses three years of filming material in a world class research laboratory of molecular biology. The film’s focus is a group of college graduates who are working towards their PhD degrees in molecular biology. The idea behind the film was to give students an idea of the process of doing science and the chance to imagine themselves as scientists. At the same time the film reveals interesting aspects about mentor-student-relationships and their sometimes gendered interaction.
Furthermore, in the obligatory text of Myers it becomes clear that also documentaries, not only fiction films, are subject to narrative constructions, i.e. within the post-production phase of selecting scenes and cutting the film material.
In the film lab the molecular structure of protein molecules are studied. The task for the PhD students is to explain the molecular structure of AMPK proteins that are involved in fat metabolism of the cell. These molecules can only be made visible when being exposed to shorter wave length x-ray beams. In order to be examined in an x-ray microscope, the protein must first be transformed into a crystal, in which many molecules are packed into a regular array.

In-Class-Time

210 minutes, including 30 minutes break.
The session can be combined with contents of Lesson Plan 5. In this case begin with the program of this lesson, followed by the group work on the text of Traweek in Lesson 5.

Schedule and Teaching Instructions

Preparing the session:
Have a DVD of the documentary "Naturally obsessed" and film screening equipment ready to show the film.

Homework for the participants in preparation for the session:

- Reading the article of Myers (2010)

Film screening:

60 minutes

Hand out the work sheet before the film screening.
Give the group the instruction when watching the film: As you watch the film, put yourself in the position of each of the students and also of Larry, the professor and lab head.
Tell them about the molecular biological background of the work in the lab.

Participants' break:

15 minutes

Group Work:

60 minutes

Building groups. Groups should not be bigger than 4 people.
Exercise on Work Sheet in Groups (you find more question to discuss in the extra material in the DVD).

Participants' Break:

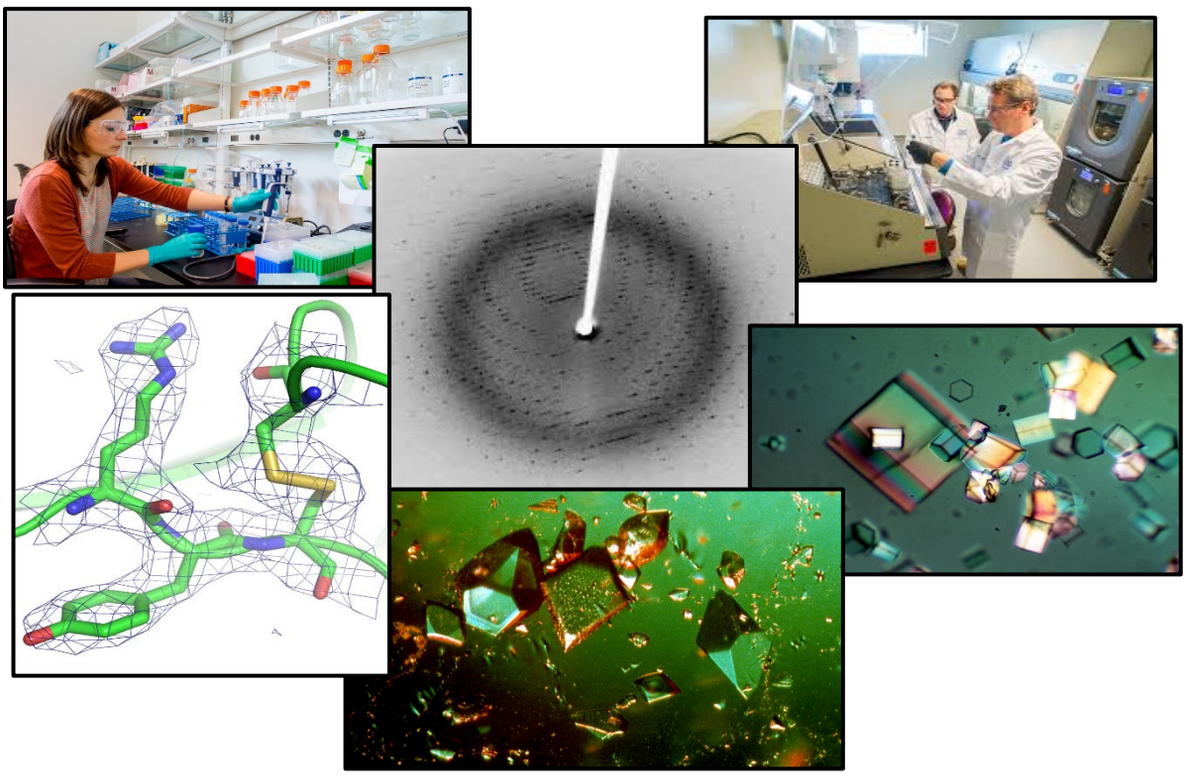
15 minutes

Group Presentation and Plenary Discussion:

60-75 minutes, depends on number of groups

Each group has 15 minutes to present their discussion results.
Then sum up the discussion.

Work Sheet: Prevailing Interaction Patterns in the Lab



As you watch the film, put yourself in the position of each of the students and also of Larry, the professor and lab head. Afterwards, discuss in your group the following questions:

1. What choices do the students make, and why?

2. What helps or hinders their progress? Do you see gender as an issue?

3. What are your impressions of how Larry mentors his students?

4. How do the students' experience in the film relate to experiences you may have had in a lab or to experiences you already have made?

5. How do you expect you would react to the experience of lab research?

6. What questions does this raise for you with regard to pursue a graduate degree?

Obligatory Reading

Myers, Natasha (2010): Pedagogy and Performativity. Rendering Lives in Science in the Documentary "Naturally Obsessed. The making of a scientist". In: *Isis* 101 (4): 817–828.

Further Reading

Conefrey, Theresa (2000): Laboratory Talk and Women's Retention Rates in Science. In: *Journal of Women and Minorities in Science and Engineering* 6 (3): 251-264.

Danielsson, Anna T. (2012): Exploring woman university physics students 'doing gender' and 'doing physics'. In: *Gender and Education* 24 (1): 25-39.

Gu, Diane Yu (2012): *The Influence of Protégé-Mentor Relationships and Social Networks on Women Doctoral Students' Academic Career Aspirations in Physical Sciences and Engineering*. Dissertation manuscript, UC Los Angeles.

Pettersson, Helena (2011): Making Masculinity in Plasma Physics: Machines, labour and experiments. In: *Science Studies* 24 (1): 47-65.

Additional Resources and Materials

- About the film: https://en.wikipedia.org/wiki/Naturally_Obsessed
- Homepage of the film http://www.naturallyobsessed.com/
- Interview with the directors Richard and Carole Rifkind, scientists: "The making of Naturally Obsessed" by Amy Charles 1 November 2009: http://www.lablit.com/article/554
- Extra Bonus Material on DVD "Naturally Obsessed"

Lesson Plan 7 - Finding suitable Work Place Cultures

Objectives

Participants learn about the concept of workplace cultures and get to know three ideal-typical cultures of physics cultures, the Worker Bee-, the Caretaker- and Hercules-culture. They learn how diverse these cultures can be, what their characteristics are and in which countries they can expect finding aspects of each of the three cultures. Furthermore, they reflect on their own experience concerning workplace cultures, get aware about their preferences and develop strategies to get information about workplace cultures in a physics department they are interested in, e.g. in the context of applications.

Introductory Notes

The analysis of different workplace cultures of physics is the basis for the participants' reflection in what kind of working environment they want to do their research. In order to allow this analysis the lesson focuses on the international research project UPGEM (Understanding Puzzles in the Gendered European Map) which was financed by EU's 6th framework programme in the period 2005-2008. The overall objective of the UPGEM project was to understand why one finds cultural diversity in the proportion of female physicists employed at universities across Europe (cf. Hasse/Trentemøller 2011). The project conducted 208 qualitative interviews at more than 20 universities in five European countries, Denmark, Italy, Estonia, Finland and Poland which led to three different but interrelated ideal type workplace cultures that are characterized by different cultural values, traditions and norms (ibid.). It is discussed how competition, creativity and risk-taking work differently in the three different scientific workplace cultures and how local meaningmaking patterns can in- and exclude male and female researchers for different reasons in the three work place cultures.

In-Class-Time

150-165 minutes, including 30 minutes break, depending on group size.

Schedule and Teaching Instructions

Homework for the participants in preparation for the session:

- Read the article of Hasse/Trentemøller (2011)

Group Work:

60 minutes

Building groups. Groups should not be bigger than 4 people.
Exercise on Work Sheet in Groups

Participants' Break:

30 minutes

Group Presentation:

60-75 minutes

Let each group present for 10 minutes at maximum their results to task number 1 and ask for aspects in their institute's culture that are Hercules-, Caretaker or Worker Bee-like. This can be the department where they work on their Bachelor, Master thesis or PhD as well as the departments they have spent some time during a summer school or an internship.

In a second step ask for their preferences concerning workplace cultures.

In the third step collect the ideas how to find out something about the culture of a (fictive) team/institute they are interested in. Discuss and evaluate the ideas. Here you can give them advice drawn form your own knowledge or experience.

Work Sheet: Finding suitable Work Place Cultures

Rethink the different prototypes of work place cultures in the text of Hasse/Trentemøller 2011: the Hercules Culture, the Worker Bee Culture and the Caretaker Culture.

1. Then, think of your own experiences in physics departments and the research groups where you have been so far, e.g. during your master or bachelor thesis, or during this summer school. Do you recognize patterns of the Hercules, Caretaker or Worker Bee culture? Use the table from Hasse/Trentemøller 2011, page 11:

Table 1 Patterns of meaning in the three work place cultures

	HERCULES	CARETAKER	WORKER BEE
Work relation	Devotion to physics. No intersection of family with work.	A healthy work life balance is prioritized. Social concern.	Research is 9-5. Private life and work life clearly divided.
Work place identity	Very individualistic. Praise initiatives, creativity. No room for weakness.	Group oriented with focus on social ties. Team can help the weak but maybe limit the creative work if the group demands it.	Work alone and keep to one self. Focus on the given task + work regulations and conditions.
Competition	One-on-one open and hidden competition is encouraged. All means are employed. Strategic thinking is necessary.	In-group competition is unacceptable–only group vs. group. The group defines the means of competition.	Uninterested & somewhat scared of competing–requires extra effort. Competition only at top-level.
Power structure	Anti-authoritarian tendencies challenge those with power through individual hidden power games.	Seemingly flat structure but entanglement of team/group and the leader's power; the leader use power to promote and protect the group. Young must earn membership are exploited by elder group members.	Clear and formal hierarchy. Distant but strong leader; one-man institutes, with many workers who can be replaced.
Gender	Being woman/mother is used negatively in competition. Gender overshadows competency–leading to cases of sexual harassment.	Group loyalty comes before gender (and competency). Few cases of conflict including sexual harassment.	Absence of competition makes gender unimportant.

2. Which work place culture does suit you best, and why? Or, which features of the three cultures would you like to find in your own (future) research team in physics?

3. When you consider entering a new work group, say for your master thesis or when applying for a PhD position, how can find out how it will be like? Think about specific questions to ask:

a) the graduate students

b) the postdocs

c) the group leader

d) the gender equality officer

Obligatory Reading

Hasse, Cathrine; Trentemøller, Stine (2011): Cultural Workplace Patterns in Academia. In: *Science Studies* 24 (1): 6-25.

Further Reading

Hasse, Cathrine; Trentemøller, Stine (2008): *Break the Pattern! A critical enquiry into three scientific workplace cultures: Hercules, Caretakers and Worker Bees*. Tartu University Press: Tartu.

Hasse, Cathrine; Trentemøller, Stine (2008): *Draw the Line! Universities as workplaces for male and female researchers in Europe.* Tartu University Press: Tartu.

Ko, Lily T. et al. (2014): Agency Of women of color in physics and astronomy: Strategies for persistence and success. In: *Journal of Women and Minorities in Science and Engineering* 20(2): 171-195.

Additional Resources and Materials

The project UPGEM: http://cordis.europa.eu/result/rcn/51993_de.html

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