ETH zürich

Gender and University Teaching - Evidence from Literature

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equal!
Equal Opportunities for Women and Men

1 Introduction

Some people hypothesize that teaching in science and engineering is not gender neutral but favours male students, i.e. the dominant population in these fields. Hereby, teaching comprises three fields: curricula, individual teaching sessions and assessments. There is also some evidence that, especially in their first, year female students feel less at ease when studying science or engineering and have, on average, worse performance compared with their male colleagues. This might be due to varying gender susceptibility to current teaching strategies and technologies. In order to alter curricula, teaching sessions and assessment in a way that is favourable for both, men and women, in-depth knowledge on gender impacts of teaching strategies and technologies would be necessary.

There are several scientific articles with some empirical evidence on these aspects. Yet, according to where and how the studies have been made, differing results concerning one and the same aspect occur. There is hardly any clear-cut evidence on how to change teaching in order to make it more gender-balanced. Hence, in the following we present the key features of recent articles concerning gender and teaching issues at the university level. The articles assessed in this report give an impression of the "state of the art". However, they cover the "gender and teaching" topic neither in a complete nor in a definitive way.

We evaluate these articles according to several criteria that we deem important:

- Country for which the study had been made
- Type and number of students that had been analysed
- Key question and assumptions
- Type of intervention
- Key results

For each of the aforementioned key topics, i.e. curricula, teaching sessions, and assessments, we draw some general conclusions based on the literature and discuss the applicability of the respective interventions in the Swiss context, especially in the context of ETH Zurich. Our final conclusions will then sketch some interventions that might be worthwhile to be tested at ETH Zurich.

2 Curricula

Study Title	Country	Type / Scope	Key Questions and Assumptions	Intervention	Findings
Wissensvermittlung und Geschlechterkonstruktionen in der Hochschullehre 2)(Münst, 2002)	Germany	Large observational study on curricula at German universities: biology, physics, computer science and architecture.	How do higher educaton institutions achieve knowledge transfer in Science, Technology Engineering and Maths (STEM) fields and how are concepts of gender constructed?	Course curricula, course material, teacher and student behavior and teaching sessions were analysed by external observers.	While gender as such is very rarely brought up during the course of a degree programme, stereotypical concepts of gender appear frequently in almost all types of interactions. Furthermore, men are seen as the exclusive target group of almost all STEM fields. The study outlines specific interventions for the fields of biology, physics, computer science and architecture.
Geschlechtergerechte Akkreditierung und Qualitätssicherung (Netzwerk Frauen- und Geschlechterforschung Nordrhein-Westfalen, Hilgemann, Kortendiek, & Knauf, 2012)	Germany	Review on gender aspects in German universities.	How can the accrediting of phased study curricula (bachelor and master, etc.) be adapted to match recent research on gender aspects?	In addition to literature research, 12 academic experts were interviewed to develop robust guidelines for the inclusion of gender aspects in accrediting.	The study assesses the importance of evaluating gender aspects for the accrediting of phased study curricula in addition to detailing gender-mainstreamed curricula developed by experts. The study observes that accrediting committees (mostly men) formulate only nonbinding guidelines for ensuring gender mainstreaming in institutions and that enforcing changes is often very difficult.
Columbia Business School (CBS) Reflects: Gender Equality (Phillips, Cashman, & Brom, 2014)	U.S.A	Observational study on 1100 students of the Columbian Business School.	How can the CBS curriculum and culture be improved to be more inclusive for all genders?	Self-reporting survey addressing the subjects: academics, admissions, careers and university campus community.	Women actively participate in the university community and both women and men have similar short- and long-term career plans. The report states that the performance in academia is not only influenced by gender but also by varying student backgrounds, levels of assertiveness and self-confidence as well as their undergraduate Grade Point Averages (GPAs).

3 Teaching Sessions

Study	Country	Type / Scope	Key Questions and Assumptions	Intervention	Findings
Girls and physics (Labudde, Herzog, Neuenschwander, Violi, & Gerber, 2000)[1]	Switzerland	Interventional study on students of 31 Swiss high-school classes.	Which teaching strategies lead to equal opportunity learning for both genders? How can physics teachers become more aware of gender issues? How can teaching strategies influence students' attitudes towards physics classes?	Development and empirical testing of teaching strategies to enhance cooperation in the classroom.	Gender-balanced teaching should be stereotype-aware, not be comprised of sexist lesson content and be as interactive and relevant for both genders as possible.
Reducing the gender gap in the physics classroom (Lorenzo, Crouch, & Mazur, 2006)	U.S.A.	Longitudinal interventional study on 1048 undergraduate students.	How do interactive teaching methods affect the gender difference in conceptual understanding of an introductory physics course?	Alternative teaching method development: peer instruction with tutorials and cooperative problem solving tasks instead of lectures.	Fully interactive teaching methods almost completely remove the gender gap in post-test performance, despite the fact that women have a weaker pre-test performance.
College faculty and the scholarship of teaching (Myers, 2008)	UK	An observational study on 82 university teachers over two semesters.	This study evaluates which teachers practice the scholarship of teaching and learning (SoTL). Are there differences between women and men? Scholarship of teaching and learning denominates the practice of treating teaching and learning as an area of science.	The data was gathered through a self-reporting survey. This study implies that the quality of teaching improves when teachers use the SoTL.	Women practice SoTL much more readily than men and this bias increases with teaching experience. This means that women tend more to inform themselves of the current state of paedagogical research than men.

[1] This study on Swiss high-school students was selected for relevant insights into course material and textbooks. We deem their findings also valid for university level teaching.

4 Examinations

Study	Country	Type / Scope	Key Questions and Assumptions	Intervention	Findings
Gender differences in student performance in large lecture classrooms (Kang, Lundeberg, Wolter, DelMas, & Herreid, 2012)	U.S.A.	Interventional study on undergraduate students of 13 introductory biology classes.	Are there gender differences in preference and performance using narrative case studies over traditional lectures?	Students were given clickers during narrative case study-type lectures and their performance was compared to traditional lectures and exams.	Women performed slightly better in clicker cases than in traditional lectures. Men however, performed markedly better in traditional lectures in most topic areas. The authors suggest that clicker cases are more favourable for women.
Gender differences in the use and effectiveness of personal response devices (King & Joshi, 2008)	U.S.A.	Interventional study on 750 undergraduate engineering students.	Is the use of clickers as an effective tool for learning and what gender differences are associated with clickers?	Two separate groups of students were given clickers during a chemistry course. Clicker use was compared to the students' final grade.	Women were more likely than men to actively participate (answering more than 75% of clicker questions), but over all, active participation is not strongly linked to student learning.
Gender, Context, and Physics Assessment (McCullough, 2004)	U.S.A.	Interventional study on 300 college students.	Do stereotypical examples in tests influence physics test performance?	Students were given ranomized physics tests with stereotypical examples.	Stereotypical examples within exam question interact with gender and therefore affect students performance on tests. Replacing male-oriented examples with female-oriented ones reduces the gender gap in performance but at the cost of lowering men's performance rather than raising women's.
Gender and mode of assessment at university (Woodfield, Earl-Novell, & Solomon, 2005)	U.S.A.	Interventional study on 650 undergraduates.	Are women better suited for coursework and men for unseen (i.e. traditional) examinations?	Assessment of student performance during coursework or exams.	Contrary to popular belief, women do not perform better at coursework over unseen examinations, but most students perceive coursework to be fairer.

5 Summary and Conclusion

Our literature review shows that for most university study programs gender aspects are not considered in their curricula. It seems as if awareness of gender disparities and differences as well as of gender stereotypes with respect to teaching and learning is rather low in higher education institutions. Hence, - as **first field of action** for the improvement of university teaching - the area of “awareness and capacity building” with respect to gender differences and the role of gender stereotypes in teaching and learning seems relevant. Concrete measures could be seminars for all university teachers that enable the docents to see in which respect their teaching does not take into account gender differences or how and where they are biased by gender stereotypes. In addition, university teachers should be equipped with different strategies to better handle the gender issue. In this context, the LET (Learning and Education Technologies) at ETH Zurich could play a decisive role. In order to have a high impact through such seminars, one could think of making them obligatory or coupling them with attractive incentives like additional resources, prizes, additional sabbaticals, teaching innovators clubs etc.

A second field of action that can be identified based on the findings from literature is the degree of interactivity in teaching sessions and examinations. Especially female students, but also male students seem to have better learning success when they are actively involved in teaching sessions and when the exams are rather run as coursework than as unseen tests. One specific interactive instrument that has been researched is the use of clickers which allows students direct participation without giving up a certain degree of anonymity. There are, however, various other instruments to enhance classroom interactivity like peer instruction, group discussions, expert puzzles etc. It seems that it would we worthwhile to advise university teachers which interactive measures they could choose and to document for specific universities which of these instruments are successful under which specific framework conditions. In that sense, it can be derived from the literature review that a unit like the LET at ETH Zurich should collect and assess data on various pilot projects making teaching sessions and examinations more interactive and make the respective information available to as many university teachers as possible. As mentioned before, one should think of ways to incentivize university teachers for getting interested and competent in this area.

A third field of action, finally, that can be suggested based on the literature studied for this report, is the intensification of research on determinants of successful university teaching and learning for both, women and men. It has turned out that there is a huge amount of studies on teaching and learning at school, including High Schools. Yet, there are only relatively few studies on teaching and learning at universities, and especially at universities with a key fo-

cus on science and engineering. Specialized professorships, essentially dealing with university teaching and exams and investigating into ways to change lessons and examinations in a way that increases the success of learning seem hence to be useful instruments.

6 Further Reading

This section contains a listing of studies that do not completely fit into the categories curricula, teaching sessions and examinations. Nevertheless, we recommend the following studies for an extended overview over the topic gender and teaching.

Insights from Primary and Secondary Education

Potter, E. F., & Rosser, S. V. (1992). Factors in life science textbooks that may deter girls' interest in science. *Journal of Research in Science Teaching*, *29*(7), 669–686.

Zohar, A., & Sela, D. (2003). Her physics, his physics: Gender issues in Israeli advanced placement physics classes. *International Journal of Science Education*, *25*(January 2015), 245–268. http://doi.org/10.1080/09500690210126766

Transition to Higher Education

Gayles, J. G., & Ampaw, F. (2014). The Impact of College Experiences on Degree Completion in STEM Fields at Four-Year Institutions: Does Gender Matter? *The Journal of Higher Education*, 85(4), 439–468. http://doi.org/10.1353/jhe.2014.0022

Liebig, B., Criblez, L., Gottschall, K., Levy, R., Sauer, B., & Sousa-Poza, A. (2014). NFP 60 Gleichstellung der Geschlechter Ergebnisse und Impulse Synthesebericht (p. 65). Bern, *CH: Swiss National Science Foundation*. Retrieved from http://www.nfp60.ch/

Lörz, M., Schindler, S., & Walter, J. G. (2011). Gender inequalities in higher education: extent, development and mechanisms of gender differences in enrolment and field of study choice. *Irish Educational Studies*, 30(July 2014), 179–198. http://doi.org/10.1080/03323315.2011.569139

Skaalvik, S., & Skaalvik, E. M. (2004). Gender Differences in Math and Verbal Self-Concept, Performance Expectations, and Motivation. *Sex Roles*, 50, 241–252. http://doi.org/10.1023/B:SERS.0000015555.40976.e6

Sonnert, G., & Fox, M. F. (2012). Women, Men, and Academic Performance in Science and Engineering: The Gender Difference in Undergraduate Grade Point Averages. *The Journal of Higher Education*, 83(1), 73–101. http://doi.org/10.1353/jhe.2012.0004

Stewart, G. (2003). Die Motivation von Frauen für ein Studium der Ingenieur- und Naturwissenschaften (Vol. N.F., 67). München, *DE: Bayerisches Staatsinstitut für Hochschulforschung und Hochschulplanung*. Retrieved from http://www.ihf.bayern.de

Gender and Ethnicity

Pittman, C. T. (2010). Race and Gender Oppression in the Classroom The Experiences of Women Faculty of Color with White Male Students. *Teaching Sociology*, 38(3), 183–196. doi:10.1177/0092055X10370120

Reid, L. D. (2010). The role of perceived race and gender in the evaluation of college teaching on RateMyProfessors.Com. *Journal of Diversity in Higher Education*, 3(3), 137–152. doi:10.1037/a0019865

Social Construction of Gender and Stereotypes

Berkowitz, D., Manohar, N. N., & Tinkler, J. E. (2010). Walk Like a Man, Talk Like a Woman Teaching the Social Construction of Gender. *Teaching Sociology*, 38(2), 132–143. doi:10.1177/0092055X10364015

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King, D. B., & Joshi, S. (2008). Gender differences in the use and effectiveness of personal response devices. *Journal of Science Education and Technology*, *17*, 544–552. http://doi.org/10.1007/s10956-008-9121-7

Labudde, P., Herzog, W., Neuenschwander, M. P., Violi, E., & Gerber, C. (2000). Girls and physics: teaching and learning strategies tested by classroom interventions in grade 11. *International Journal of Science Education*, *22*(January 2015), 143–157. http://doi.org/10.1080/095006900289921

Lorenzo, M., Crouch, C. H., & Mazur, E. (2006). Reducing the gender gap in the physics classroom. *American Journal of Physics*, *74*(2006), 118. http://doi.org/10.1119/1.2162549

McCullough, L. (2004). Gender , Context , and Physics Assessment. *Journal of International Women’s Studies*, *5*(4), 20–30.

Münst, A. S. (2002). Wissensvermittlung und Geschlechterkonstruktionen in der Hochschullehre. *Ein Ethnographischer Blick Auf Natur- Und Ingenieurwissenschaftliche Studienfächer*, *108*. Retrieved from http://scholar.google.ch/scholar?q=Senganata+M%C3%BCnst&btnG=&hl=en&as_sdt=0%2C5#0

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Woodfield, R., Earl-Novell, S., & Solomon, L. (2005). Gender and mode of assessment at university: Should we assume female students are better suited to coursework and males to unseen examinations?, (January 2015), 37–41. http://doi.org/10.1080/0260293042003243887

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