



# Women in Science

## The Effect of Training on Gender Bias Reduction in Academia

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Master thesis Psychology, Social and Organizational Psychology
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**Abstract**

Despite the fact that people think, nowadays, men and women have the same career opportunities, implicit gender bias is still an important contributor to the underrepresentation of women in academia. In this study the effect of training on gender bias reduction in academia was examined. In a randomized study (n = 176) participants were assigned to one of the eight conditions within a 2 (gender applicant: male vs. female) x 2 (training statistics: training vs. no training) x 2 (training implicit gender bias: training vs. no training) between subjects design and rated application materials of a candidate for an assistant professor job. Implicit gender bias training had more effect on reducing gender bias than statistic training. Exposure to both trainings did not lead to less gender bias than exposure to only one of these trainings. The results indicated that creating awareness of the existence of implicit gender bias is an important step in reducing gender bias in academia.

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**Women in Science: The Effect of Training on Gender Bias Reduction in Academia**

The Netherlands is generally seen as a country where men and women have equal rights and opportunities. In many aspects this is indeed the case. Girls have the same opportunities to go to school and university as boys. Nowadays, even more than half (53.6%) of the graduates from university are female students. However, this trend is not visible at all in the higher positions in academia. In 2012, only 14.8% of the full professors were female (Stichting de Beauvoir, 2012). The transition from graduate programs to assistant professorships shows a remarkable leakage of women in the fields where women are prevalent: Psychology, life-sciences and social sciences (Ceci, Ginther, Kahn, & Williams, 2014). Women are overrepresented at graduation level, but afterwards more women leave the field of science than men. Therefore women are underrepresented at higher academic levels.

The underrepresentation of women in higher academic job functions could be explained by the fact that women choose to leave their academic career earlier than men. Many women see research as something that is incompatible with raising a family (Shen, 2013). Moreover, experts say that the lack of role models in the higher positions of academia is contributing to the drop out of women (Shen, 2013). Apart from these possible explanations, implicit gender bias is still a very important contributor to the underrepresentation of women. Research has shown that women are still judged to be less competent than men, and this leads to a lower hireability and a lower salary than men in higher job functions in academia. Both male and female evaluators have this gender bias (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012). This is a severe problem, because it does not give men and women equal career opportunities and rewards, which can lead to a loss of scientific talent and human capital. It is important to fully use the scientific talent and human capital, since this will enhance and accelerate scientific explorations.

As indicated above, it is important to reduce gender bias. In this study we examine the effect of training on reducing gender bias. This leads to the following research question: *Can training reduce gender bias in academia?*

**Gender Similarities and Differences**

In the last centuries there has been much debate about the question whether men and women are fundamentally different. The gender similarities hypothesis states that men and women are similar on most, but not all, psychological variables (Hyde, 2005). Various studies support this hypothesis (Hyde, 2014). Important similarities are found in the domains of mathematics performance, verbal skills, some personality dimensions such as gregariousness

and conscientiousness, reward sensitivity, tentative speech, leadership effectiveness, self-esteem and academic self-concept. These similarities are relevant to exclude the possibility of objective differences between men and women. Women are equally capable in the above mentioned domains as men. Therefore, these similarities cannot explain the difference in evaluation of men and women. As the gender similarities hypothesis states, there are also some exceptions to the general rule. These exceptions include, 3D mental rotation, the personality dimension of agreeableness/tender-mindedness, sensation seeking, interests in things versus people, physical aggression, some sexual behaviours and attitudes about casual sex (Hyde, 2014). Nevertheless, these differences do not seem relevant for the majority of academic careers, because they are not specifically related to the competencies necessary for an academic career.

If we have a look at the similarities and differences between men and women, these do not seem to be plausible explanations for the difference in academic career opportunities between men and women. However a difference in career opportunities between men and women does still exist (Moss-Racusin et al., 2012; Reuben, Sapienza, & Zingales, 2014; Steinpreis, Anders, & Ritzke, 1999).

**Gender Stereotypes and Prejudices**

As mentioned above, although there are no relevant differences between men and women when it comes to the competencies necessary for an academic career, people do still evaluate men and women different. This can be caused by gender stereotypes. Stereotypes are certain beliefs about groups of people (Fiske & Taylor, 2013). According to the stereotype content model (SCM), people judge groups on two dimensions: “warmth” and “competence”. The first dimension describes the group’s intention for good or ill, whereas the second dimension describes whether the group can enact their intentions (Fiske & Taylor, 2013). Stereotypes along these two dimensions result from structural relations between groups. Eckes (2002) showed in his study that the relative status of a group predicts the perception of competence, whereas the nature of the groups’ interdependence (cooperative vs. competitive) predicts the perception of warmth. Men are often seen as more competent, because they have a higher status. Women on the other hand, are often seen as more cooperative than men and are therefore perceived to be more warm than men.

Stereotypes can be implicit or more explicit. Implicit stereotypes assess more automatic and less conscious aspects, for example (unconsciously) associating science more with men than women. On the other hand, explicit stereotypes assess those aspects that

emerge as conscious knowledge that is willingly reported, for example saying that you find men more competent for the academic working field than women (Miller, Eagly, & Linn, 2014). These stereotypes can lead to prejudices. Prejudices are evaluations of and feelings about groups. Stereotypes are the cognitive side of intergroup bias, whereas prejudices are the affective side of intergroup bias (Fiske & Taylor, 2013). For example, a stereotype about women can be that they are not good in solving mathematical problems. The prejudice relating to this stereotype can be that women are stupid because they are not good in solving mathematical problems.

Miller et al. (2014) investigated how national differences in women's science participation related to gender-science stereotypes that associate science more with men than women. Results showed that there was a strong relationship between women's representation in science and national gender-science stereotypes. Higher female enrolment in tertiary science education related to weaker explicit and implicit national gender-science stereotypes. Miller et al. (2014) suggested that, in order to change implicit gender-science stereotypes, people need to have repeated and varied exposure to counter stereotypic women. Unfortunately, this counter stereotypic exposure is not yet visible in our own society and people often have stereotypic gender associations and gender prejudices. Recently, the Dutch (female) minister of Education, Culture and Science presented the Science Vision 2025. In this document a picture of 16 important Dutch scientists was included. This picture showed only male scientists. In the same document they mentioned that implicit bias is possibly causing the low number of women in science (Ministerie van Onderwijs, Cultuur en Wetenschap, 2014). The picture of only male scientists was an example implicit bias, because without explicitly mentioning the bias, it showed that science is a working field for men. So, even when people have the right intentions, they are often unaware of their own implicit gender stereotypes. These stereotypes can lead to unequal treatment of men and women (gender bias).

**Gender Bias**

Various studies have examined the existence of gender bias in academia. Most of the results support the hypothesis that gender bias still exists in academia. A few of the studies are discussed in more detail below.

In the study of Steinpreis et al. (1999) 238 male and female academic psychologists were sent one of four versions of a curriculum vitae (i.e., female job applicant, male job applicant, female tenure applicant and male tenure applicant). The curriculum vitae of the

(male and female) job applicant came from a real life scientist who had used the vitae to get a tenure track right out of graduate school. The curriculum vitae of the (male and female) tenure applicant came from the same scientist, but at a later stage of his/her career. (S)he used this vitae to get early tenure. The curriculum vitae of the male and female job applicant was exactly the same, except for the name on it. This was also the case for the male and female tenure applicant. The name was changed into either a traditional male or female name. Results showed that both men and women were more likely to hire a male job applicant than a female job applicant with an identical record. They were also more likely to positively evaluate the research, teaching and service contributions of a male applicant than a female applicant with an identical record. In contrast to the female job applicant, the female tenure applicant was equally likely to be hired as the male tenure. This difference between job applicants and tenure candidates might be explained by the fact that the quality of the curriculum vitae of the tenure applicant was very high. Therefore, the vast majority of the participants said they would have tenured the tenure applicant, regardless of the gender. This indicates that a superb record can function as a buffer for gender bias when making promotional decisions. This result is in line with the findings of Ceci et al. (2014), who found evidence that especially in the transition of graduate programs to assistant professorships there is a pipeline leakage of women.

Foschi (2000) reported various situations in which individuals were treated with different standards depending on who they were, even though the attribute being evaluated was objectively similar for all individuals. Gender was one of the characteristics in which people used double standards for evaluation. In one of the studies (Foschi, Lai, & Sigerson, 1994) male and female undergraduates were told they were members of a university-wide committee making recommendations on the selection of applicants for engineering positions. Participants had to choose between a male and a female applicant with equally average, but slightly different academic records. In one condition the male applicant had a slightly better record, in the other condition the female applicant had a slightly better record. Results from male participants showed that when the male applicant was the better performer, he was chosen more often and considered more competent and suitable for the job than when the female applicant was in that position. The results supported the hypothesis that women have to perform better and more than men in order to be perceived equally competent as men. In contrast to the findings of Steinpreis et al. (1999) did female evaluators not show this double standard.

Another important contribution to the literature of gender bias is the study of Moss-Racusin et al. (2012). In this study, science faculty from research-intensive universities rated application material of a student for a laboratory manager position. Faculty participants randomly received application material with a male or female name on it. This application material was, except for the name on it, identical. Participants rated the male applicant significantly more competent and hireable than the identical female applicant. Additionally, they selected a higher starting salary and offered more career mentoring to the male applicant. In line with Steinpreis et al. (1999), both male and female evaluators showed gender bias. The results confirm the presence of gender bias in academia.

**Reducing Gender Bias**

Since previous studies have shown gender bias is still present in academia, it is important to examine the possibilities of reducing this bias. Various studies have examined different approaches to reduce gender bias. Two of them are discussed below.

Carnes et al. (2012) approached implicit bias as a remediable habit. To move from motivation to action, both self-efficacy and positive outcome expectations are required. To maintain this action, deliberate practice is required. Participants in this study participated in a Bias Literacy Workshop. This workshop addressed the following requirements for intentional behavioural change: Generating recognition of a need to change and stimulating a desire to act, providing tools to engage in a new behaviour, helping envision a link between action and desired outcome and deliberate practice of the behavioural change. The workshop engaged the participants in self-reflection and problem-solving, and provided opportunities for practice in changing behaviour with immediate feedback. To increase awareness of implicit bias and help to motivate participants, they were invited to take an Implicit Association Test (IAT) before the workshop. Results showed that in four to six months after participation in the workshop, three-quarters of the interviewees not only demonstrated increased bias awareness, but described plans to change - or had actually changed - behaviours that they attributed to the workshop. For example, a male participant stated that in the future when he will do a review he will try not to look at the name or any background first. Unfortunately, long term effects of the workshop, such as more equitable hiring, were not analysed yet.

Jackson, Hillard and Schneider (2013) also supported the positive effect of training on reducing gender bias. They showed that gender diversity training had a positive effect for men on the implicit attitudes towards women in the field of science, technology, engineering and math (STEM). The gender diversity training presented data on the representation of women in

STEM nationally and locally, the local workplace climate, research on the effects that implicit bias has on hiring, promotion and retention, and ways to overcome bias. The results showed that women already had a positive implicit association between women and the STEM field before training, and therefore the training had no effect.

The studies mentioned above, show that certain trainings can have a positive effect on reducing gender bias. In the following paragraph the purpose of the present study and the trainings involved in it will be discussed.

**Present Study**

In the present study we elaborated on the studies of Moss-Racusin et al (2012) and Jackson et al. (2013). The purpose of the present study was to investigate the effect of two types of training on gender bias reduction in academia. To measure gender bias, we used perceived competence as our main dependent variable. Secondary dependent variables were hireability and proposed salary. These three variables were based on measures of Moss-Racusin et al. (2012) and had been well-validated and tested in this study. Since the study of Moss-Racusin et al. (2012) showed that there was no difference between male or female participants in showing gender bias, this variable was not included in the present study.

The effect of training on reducing gender bias was examined by exposing people to statistics of the underrepresentation of women in academia and/or by exposing them to information about implicit gender bias. People are often unaware of implicit biases they and others might have and it might even contradict one's conscious explicit beliefs (Devine, 1989). By making them aware of this implicit bias, this could lead from unconscious incompetence, to conscious incompetence, to conscious competence and in the end a change of their behaviour (Carnes et al., 2012). In the present study, this means in the beginning, people were not aware of women being perceived as less competent than men. After being exposed to the training this could lead to awareness of implicit gender bias. This could lead to a higher perceived competence of women and in the end to a higher evaluation of women.

Foregoing information led to the following hypotheses (see also Figure 1).

**Hypothesis 1:** *Individuals who have been exposed to statistics of the underrepresentation of women in academia, show less gender bias than individuals who have not been exposed to statistics of the underrepresentation of women in academia.*

**Hypothesis 2:** *Individuals who have been exposed to information about implicit gender bias, show less gender bias than individuals who have not been exposed to information about gender bias.*

**Hypothesis 3:** *Individuals who have been exposed to both statistics about the underrepresentation of women in academia and information about implicit gender bias, show less gender bias than individuals who have been exposed to only one of these trainings.*

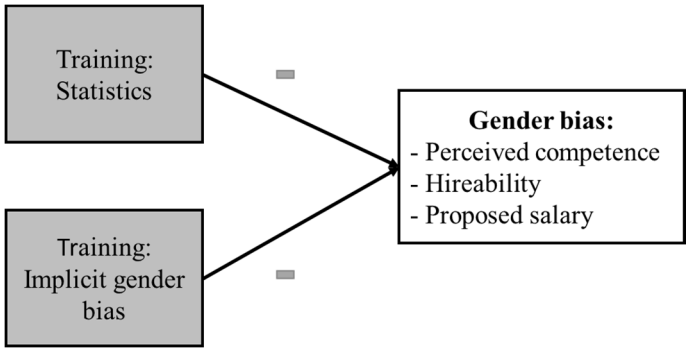


*Figure 1.* Model representing the hypothesized effects of training statistics and training implicit gender bias on gender bias in academia

## Method

### Participants and Design

The sample of the experiment consisted of 176 participants. The participants were recruited at the University of Leiden and within the personal network of the researchers. Recruitment was done by email advertisements, advertisements on Facebook, and by asking people personally. Hundred-and-twenty-one women (68.4%) and 56 men (31.6%) participated in the study. The mean age of participants in the sample was 23 years old (*SD* = 7.32). 96.6% of the participants had a Dutch nationality. The other 3.4% had a Moroccan, German, Swiss or Australian nationality. 87.5% of the participants had finished or was currently following an (applied) academic study. The other 12.6% had finished or was currently following lower education or secondary school. 29.4% of the participants was either working, looking for a job or not specified.70.6% of the participants was student. 44.6% of these students were psychology students. The other 55.4% were students with various fields of study.

Participants were randomly assigned to one of the eight conditions within a 2 (gender applicant: male vs. female) x 2 (training statistics: training vs. no training) x 2 (training implicit gender bias: training vs. no training) between subjects design. The main dependent measures were perceived competence, hireability and proposed salary.

**Procedure**

Upon arrival, participants were asked to read and sign the informed consent form. After signing, the participant took place behind a computer in a small room with no other people present. This experiment was part of a larger experimental session and combined with another experiment, in which the effect of music on choosing a movie was tested. Participants first joined the music/movie experiment, which took approximately 15 minutes. After that they joined the present experiment. This took approximately 20 minutes. Participants were given 5 euro's or 2 credits for participation in the two experiments.

Participants were told that the experiment was about selection procedures and were asked to imagine themselves in the role of employer, looking for the right candidate for an assistant professor job. They were told that professors are very important in academia, and the job of assistant professor is important for individuals who aspire a career in academia, but that still little is known about the factors that influence the decision to hire a specific person from a group of candidates. Therefore, application materials from real candidates who applied for an assistant professor job at the university had been collected. This information was abstracted by a standardized form. This way it would be easier for the experimenters to compare the evaluations. The participants were asked to read the application materials and afterwards give their opinion about the candidate. Every participant evaluated one candidate. They were told that all candidates were interested in the assistant professor job, with the aim of enhancing their chances in an academic career. Participants were asked to evaluate the candidate within this context. After the participants were assigned to one of the eight conditions, they were presented information depending on their condition. Participants in the statistic training condition were presented statistics about the underrepresentation of women in academia. Participants in the implicit gender bias condition were presented information about implicit gender bias. These conditions are described in more detail below (see *Materials)*. Participants in the no statistic training, no implicit gender bias training condition, were not presented any extra information. After participants took part in either both, one or neither of the trainings, they were presented the application materials. Depending on the gender applicant conditions, they either received application material with a male name

(Thomas) on it, or application material with a female name (Sanne) on it. Each participant only saw one set of materials, from either a male or a female applicant. The materials of the male and female applicant were identical. Participants were asked to evaluate the applicant, by means of a questionnaire (see *Measures*). After completion, they were thanked, fully debriefed, and paid.

**Materials**

**Application material**. The application material existed of a standardized form, which included demographics, background information about study results and experience, and parts of a motivation letter and a letter of recommendation. In the demographics section, information about the gender of the applicant, name (Sanne or Thomas), age (27), nationality (Dutch) and highest level of education completed (Ph.D. in Social and Organizational Psychology) was given. In the background section, the grade average of the masters study (7.5) and thesis (8.0) was given. Besides, it showed that the applicant was experienced in academic research and had the ambition to become a professor. The motivation letter described a motivated applicant, that was interested and willing to learn new skills. The letter of recommendation was moderately positive: It said that after a period of getting used to the academic world, the applicant was a hard worker and achieved good results (see *Appendix A)*. The application material of the candidate was designed to reflect slightly ambiguous competencies.

**Statistics about underrepresentation of women.** In this information document statistics about the underrepresentation of women in academia were presented. The document showed that, although there were more female graduates than male graduates at Dutch universities in 2011, the percentage of women decreased in every career step in academia. Of all full professors employed at Dutch universities in 2011 only 14.8 % was female (see *Appendix B*).

**Information about implicit gender bias**. In this information document, the phenomenon of implicit gender bias was explained and research results of studies about gender bias were presented. Gender bias was explained as the phenomenon that people unconsciously evaluate men different (i.e., more positively) than women and that this can lead to unequal treatment of men and women. Research results of Moss-Racusin et al. (2012) and Foschi (2000) were presented to support the hypothesis that men are seen as more competent than women, and women have to perform better than men to be seen as equally competent. The results of the studies also showed that gender bias could not be attributed to less ambition or motivation of women *(*see *Appendix C).*

**Measures**

The measurement scales that were used in the present study were based on measures of Moss-Racusin et al. (2012). These scales had been well-validated and modified for use from previous studies (Moss-Racusin, Phelan, & Rudman, 2010; Moss-Racusin & Rudman, 2010; Rudman, Moss-Racusin, Phelan, & Nauts, 2012). Since the sample existed of Dutch speaking participants, the items of the different scales were translated into Dutch.

**Perceived competence.** The perceived competence of the applicant was assessed by using six items on a 1 (not at all) to 7 (very much) scale. Examples of these items were: (i) "Did the applicant strike you as competent?" (ii) "How likely is it that the applicant has the necessary skills for this job?" (iii) "How qualified do you think the applicant is?"
The six items were averaged to form the competence scale ($\alpha$ = .91), with higher numbers indicating greater levels of perceived competence (Moss-Racusin et al., 2012).

**Hireability.** The extent to which the applicant was viewed as hireable for the assistant professor job was measured using three items on a 1 (not at all likely) to 7 (very likely) scale. These items were: (i) "How likely would you be to invite the applicant to an interview for the assistant-professor job? (ii) "How likely would you be to hire the applicant for the assistant-professor job?" (iii) "How likely do you think it is that the applicant was actually hired for the assistant-professor job he/she applied for?" The three items were averaged to form the hireability scale ($\alpha$ = .90), with higher numbers reflecting greater levels of perceived hireability (Moss-Racusin et al., 2012).

**Proposed salary.** Proposed salary was measured using one item: "If you had to choose one of the following starting salaries for the applicant, what would it be? (Average gross salary of a full time job in 2014 was €35,000)". Responses were indicated on the following scale: 1 (€20,000), 2 (€25,000), 3 (€30,000), 4 (€35,000), 5 (€40,000), 6 (€45,000), 7 (€50,000), 8 (€55,000).

**Additional measures.** The following additional measures were included in the questionnaire.

***Stereotyping.*** The extent to which applicants were stereotyped was measured using 19 items on a 1 (not at all likely) to 7 (very likely) scale. The five stereotyping scales measured by these items were: morality (e.g., "honest"; $\alpha$ = .90), sociability (e.g., "kind"; $\alpha$ = .92), competence (e.g., "intelligent"; $\alpha$ = .86), masculine gendered stereotypes (e.g., "self-confident"; $\alpha$ = .78) and neutral gendered stereotypes (e.g., "innovative"; $\alpha$ = .67); Leach, Ellemers, & Barreto, 2007)

***Mentoring.*** The extent to which the applicant was perceived as suitable for mentoring was measured using four items on a 1 (not at all likely) to 7 (very likely) scale (e.g., "This candidate would give extra help to students when they are struggling with something"; $\alpha$ = .81; Moss-Racusin et al., 2012).

***Likeability.*** The extent to which the applicant was perceived as a likeable person was measured using three items on a 1 (not at all likely) to 7 (very likely) scale (e.g., "How much do you like this candidate?"; $\alpha$ = .70; Moss-Racusin et al., 2012)

***Academic career aspirations.*** The extent to which the participant aspired an academic career was measured using four items on a 1 (not at all likely) to 7 (very likely) scale (e.g., "It is my ambition to become a respected scientist"; $\alpha$ = .82).

***Career aspirations.*** The extent to which the participant aimed for a higher job function in their career was measured using 10 items on a 1 (not at all likely) to 7 (very likely) scale (e.g., "I hope to become a leader in my career field"; $\alpha$ = .76; O'Brien, 1995).

***Subtle sexism.*** The modern sexism scale measured the extent to which the participant thought women and men were still unequally treated within society. This was measured using eight items on a 1 (not at all likely) to 7 (very likely) scale (e.g., : "Discrimination against women is no longer a problem"; $\alpha$ = .84; Swim, Aikin, Hall, & Hunter, 1995).

***Affirmative action.*** The extent to which the participant thought affirmative action (positive action) was an effective way of reducing gender bias, was measured using four items on a 1 (not at all likely) to 7 (very likely) scale (e.g., "Positive action is necessary to decrease the differences in chances between men and women"; $\alpha$ = .68; Brutus, Parra, Hunter, Perry, & Duchame, 1998).

***Gender identification.*** The extent to which the participant identified him or herself with their own gender, was measured using four items on a 1 (not at all likely) to 7 (very likely) scale (e.g., "I am happy to be a man/woman"; $\alpha$ = .64 for female participants and $\alpha$ = .54 for male participants; Kiefer & Sekaquaptewa, 2007)

***Gender dignity.*** The extent to which the participant saw him or herself as a dignified man or woman was measured using four items on a 1 (not at all likely) to 7 (very likely) scale (e.g., "I am a decent man/woman to cooperate with"; $\alpha$ = .48 for female participants and $\alpha$ = .55 for male participants; Luhtanen & Crocker, 1992).

Since both gender identification and gender dignity had a low reliability and the scales were not necessary in order to examine the hypotheses, they were not taking into account in the following analyses.

**Specified plan of analysis**

The statistical analyses were carried out by using IBM SPSS Statistics (version 21). All hypotheses were examined by three analyses. First, the assumptions (normality, homogeneity of variance and independent errors) and possible outliers were checked. After that, ANOVA analyses were performed.

The independent variables of all ANOVA analyses were gender of applicant (male vs. female), training statistics of the underrepresentation of women in academia (training vs. no training) and training implicit gender bias (training vs. no training). The dependent variables varied across the three ANOVA analyses: perceived competence, hireability and proposed salary. Furthermore, seven ANOVA-analyses were performed for the additional measures.

## Results

After the data collection, two participants were removed from the analyses, due to limited understanding of the Dutch language and an error in the computer, which resulted in unreliable results.

Before the ANOVA analyses were conducted, the dataset was checked on outliers and the assumptions were checked. In the data of perceived competence one negative outlier was found ($z_{resid}$ = -3.12). Since the influence of this outliers was very small (*Cook's distance* = .05), it was not removed from the dataset. In the data of hireability four negative outliers were found ($z_{resid}$ = -3.68, -3.03, -3.25, respectively -3.21). The influence of these outliers was also very small (*Cook's distance* =.11, .08, .07 respectively .05). Therefore, they were not removed from the dataset. In the data of proposed salary, no outliers were found.

Since all cells of the sample had a size larger than 15, *F* was robust for normality. The difference between the biggest cell size and the smallest cell size was less than a factor 2. This made *F* robust for homogeneity of variance. According to the design of the study the assumption of independence of errors was met.

In the following paragraphs, main effects of independent variables will only be discussed when interaction effects were not present.

**Perceived Competence**

No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on perceived competence, $F(1,166) = 0.25$, $p = .62$, $\eta_p^2 = .00$.

A marginally significant interaction effect was found between training statistics and gender applicant on perceived competence, $F(1,166) = 3.87$, $p = .05$, $\eta_p^2 = .02$. As can be seen in Figure 2 and Table 1, individuals who had been exposed to statistics of the underrepresentation of women in academia, evaluated the female applicant as more competent ($M_{competence} = 5.69$, $SD = 0.15$) than individuals who had not been exposed to these statistics ($M_{competence} = 5.60$, $SD = 0.12$). At the same time, the male applicant was evaluated less competent after individuals had been exposed to statistics of the underrepresentation of women in academia ($M_{competence} = 5.14$, $SD = 0.13$) compared to individuals who had not been exposed to these statistics ($M_{competence} = 5.58$, $SD = 0.15$). The difference in perceived competence between training statistics and no training statistics was bigger for the male applicant than for the female applicant.

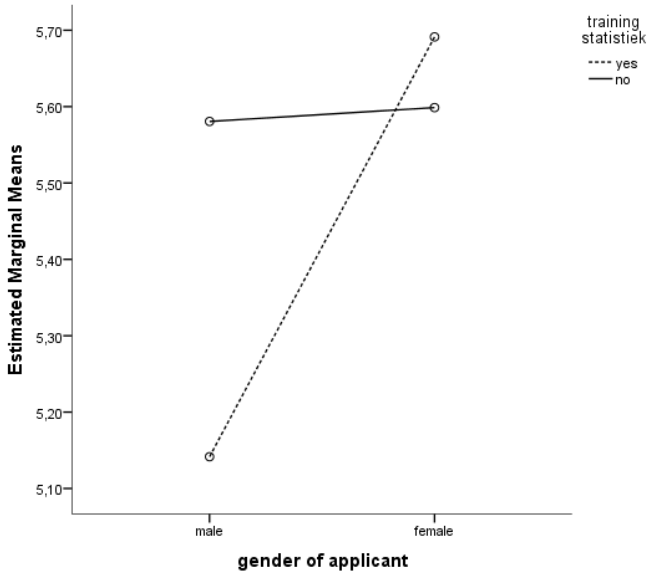


*Figure 2.* Interaction effect of training statistics * gender applicant on perceived competence

A significant interaction effect was found between training implicit gender bias and gender applicant on perceived competence, $F(1,166) = 12.58$, $p < .01$, $\eta_p^2 = .07$. This effect indicates that the female and male applicant were evaluated differently after participants took part in a gender bias training compared to participants who did not take part in the gender bias training. As can been seen more specifically in Figure 3 and Table 1, individuals who had been exposed to information about implicit gender bias evaluated the female applicant as more competent ($M_{competence} = 5.84$, $SD = 0.14$) than individuals who had not been exposed to this information ($M_{competence} = 5.45$, $SD = 0.13$). On the other hand, the male applicant was

evaluated as less competent by individuals who had been exposed to information about implicit gender bias ($M_{competence}$ = 5.07, *SD* = 0.14), compared to individuals who had not been exposed to this information ($M_{competence}$ = 5.65, *SD* = 0.14).

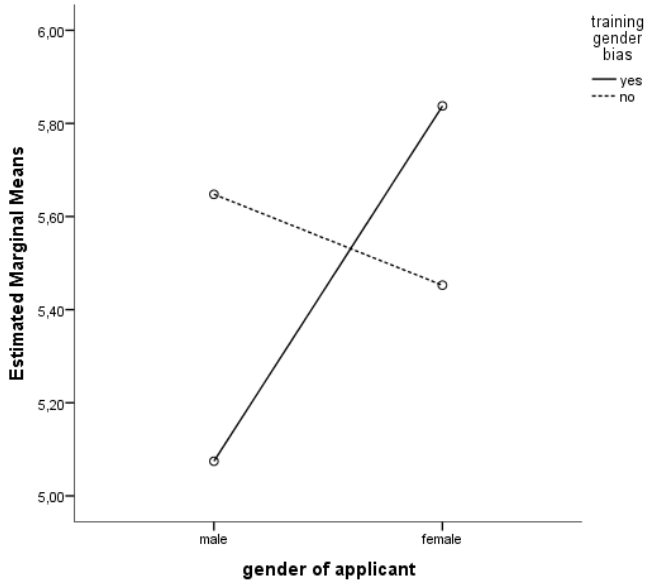


*Figure 3.* Interaction effect of training gender bias * gender applicant on perceived competence

**Hireability**

No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on hireability, $F(1,166) = 1.38$, $p = .24$ $\eta_p^2 = .01$.

Also no significant interaction effect was found between training statistics and gender applicant on hireability, $F(1,166) = 1.87$, $p = .18$, $\eta_p^2 = .01$.

A significant interaction effect was found between training implicit gender bias and gender applicant on hireability, $F(1,166) = 14.34$, $p < .01$, $\eta_p^2 = .08$. This effect indicates that women and men are evaluated differently after participants had a training in gender bias. As can been seen more specifically in Figure 4 and Table 1, individuals who had been exposed to information about implicit gender bias, evaluated the female applicant as more hireable ($M_{hireability}$ = 5.80, *SD* = 0.17) than individuals who had not been exposed to this information ($M_{hireability}$ = 5.34, *SD* = 0.15). On the other hand, the male applicant was evaluated as less hireable by individuals who had been exposed to information about implicit gender bias ($M_{hireability}$ = 4.93, *SD* = 0.16) compared to individuals who had not been exposed to this information ($M_{hireability}$ = 5.67 *SD* = 0.16).

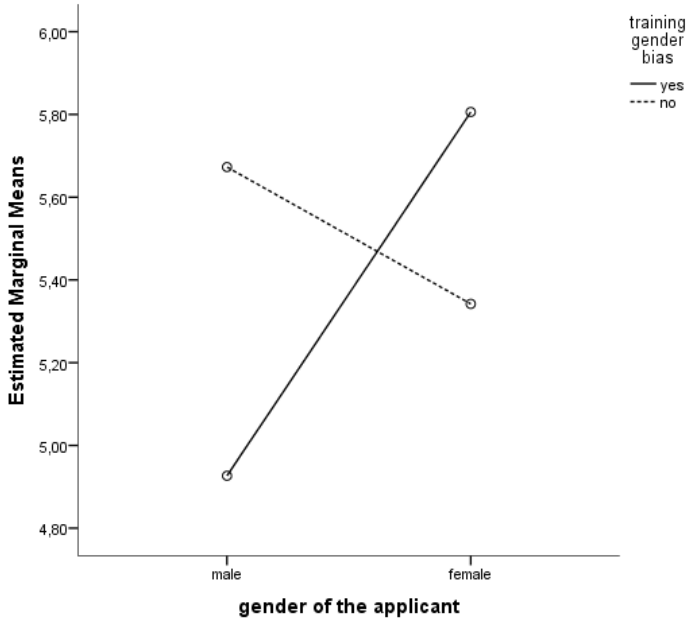


*Figure 4.* Interaction effect of training gender bias * gender applicant on hireability

**Proposed Salary**

No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on proposed salary, $F(1,166) = 0.43$, $p = .51$, $\eta_p^2 = .00$.

No significant interaction effect was found between training statistics and gender applicant on proposed salary, $F(1,166) = 0.00$, $p = .98$, $\eta_p^2 = .00$.

Also, no significant interaction effect was found between training gender bias and gender applicant on proposed salary, $F(1,166) = 1.47$, $p = .23$, $\eta_p^2 = .01$.

Lastly, a marginally significant main effect of gender applicant was found on proposed salary, $F(1,166) = 3.14$, $p = .08$, $\eta_p^2 = .02$. The reliability of this result was, however, rather small. Therefore, no conclusions could be drawn from it.

Table 1. *Means (and standard deviations) of training statistics, training implicit gender bias, both trainings and no training on perceived competence, hireability and proposed salary*

| | Male applicant | | | | Female applicant | | | |
|---|---|---|---|---|---|---|---|---|
| | No TS | | TS | | No TS | | TS | |
| | No TGB | TGB | No TGB | TGB | No TGB | TGB | No TGB | TGB |
| Perceived competence | $6.09_{ai}$ (0.21) | $5.07_{bi}$ (0.21) | $5.20_{aj}$ (0.18) | $5.08_{bj}$ (0.17) | $5.56_{ci}$ (0.17) | $5.63_{di}$ (0.18) | $5.34_{ci}$ (0.19) | $6.04_{di}$ (0.22) |
| Hireability | $6.06_{a}$ (0.24) | $4.80_{b}$ (0.25) | $5.29_{a}$ (0.22) | $5.05_{b}$ (0.20) | $5.32_{c}$ (0.20) | $5.65_{d}$ (0.21) | $5.36_{c}$ (0.22) | $5.96_{d}$ (0.26) |
| Proposed salary | $3.50_{a}$ (0.28) | $3.77_{a}$ (0.29) | $3.48_{a}$ (0.25) | $3.33_{a}$ (0.23) | $3.73_{a}$ (0.24) | $4.20_{a}$ (0.24) | $3.46_{a}$ (0.26) | $4.00_{a}$ (0.30) |

TS = training statistics, TGB = training gender bias
*Note*: Different subscripts per row indicate significant differences, $p < .05$.

**Additional Measures**

***Stereotyping.*** A significant difference was found between the male and female applicant in the extent to which they were attributed the stereotype sociability, $F(1,172) = 6.12$, $p = .01$, $\eta_p^2 = .03$. The female applicant was seen as more sociable ($M = 5.15$, $SD = 0.09$) than the male applicant ($M = 4.82$, $SD = 0.10$). No significant differences were found between the male and female applicant in the extent to which they were attributed the stereotypes morality ($F[1,172] = 2.71$, $p = .10$, $\eta_p^2 = .02$), competence ($F[1,172] = 2.32$, $p = .13$, $\eta_p^2 = .01$), masculine gendered stereotypes ($F[1,172] = 0.00$, $p = .97$, $\eta_p^2 = .00$ or neutral gendered stereotypes ($F[1,172] = 0.65$, $p = .42$, $\eta_p^2 = .00$). No significant 3-way interaction effects were found between training statistics, training implicit gender bias and gender applicant on morality ($F$ [1,166] = 0.39, $p = .53$, $\eta_p^2 = .00$), sociability ($F$ [1,166] = 0.42, $p = .52$, $\eta_p^2 = .00$), competence ($F$ [1,166] = 0.23, $p = .63$, $\eta_p^2 = .00$), masculine gendered stereotypes ($F$ [1,166] = 0.19, $p = .66$, $\eta_p^2 = .00$) and neutral gendered stereotypes ($F$ [1,166] = 0.06, $p = .81$, $\eta_p^2 = .00$).

***Mentoring.*** A significant difference was found between the male and female applicant in the extent to which they were perceived as suitable for mentoring, $F(1,172) = 4.53$, $p = .04$, $\eta_p^2 = .03$). The female applicant was seen as more suitable for mentoring ($M = 5.60$, $SD = 0.09$) than the male applicant ($M = 5.32$, $SD = 0.09$). No significant 3-way interaction effect

was found between training statistics, training implicit gender bias and gender applicant on mentoring, $F(1,166) = 0.62$, $p = .44$, $\eta_p^2 = .00$.

***Likeability.*** A significant difference was found between the male and female applicant in the extent to which they were perceived as a likeable person, $F(1,172) = 12.59$ $p < .01$, $\eta_p^2 = .07$). The female applicant was perceived as more likeable ($M = 5.01$, $SD = 0.10$) than the male applicant ($M = 4.51$, $SD = 0.10$). No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on likeability, $F(1,166) = 0.04$, $p = .84$, $\eta_p^2 = .00$.

***Academic career aspirations.*** No significant difference was found between the participants who evaluated the male applicant and the participants who evaluated the female applicant in the extent to which they aspired an academic career, $F(1,172) = 2.57$, $p = .11$, $\eta_p^2 = .02$). No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on academic career aspirations, $F(1,166) = 0.00$, $p = .97$, $\eta_p^2 = .00$.

***Career aspirations.*** No significant difference was found between the participants who evaluated the male applicant and the participants who evaluated the female applicant in the extent to which they aspire a higher job function in their career, $F(1,172) = .23$, $p = .63$, $\eta_p^2 = .00$). No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on career aspirations, $F(1,166) = 0.62$, $p = .44$, $\eta_p^2 = .00$.

***Subtle sexism.*** No significant difference was found between the participants who evaluated the male applicant and the participants who evaluated the female applicant in the extent to which the participant thought women and men were still unequally treated within society, $F(1,172) = 2.18$, $p = .14$, $\eta_p^2 = .01$). No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on sexism, $F(1,166) = 0.20$, $p = .66$, $\eta_p^2 = .00$.

***Affirmative action.*** No significant difference was found between the participants who evaluated the male applicant and the participants who evaluated the female applicant in the extent to which the participant thought affirmative action was an effective way of reducing gender bias, $F(1,172) = 2.32$, $p = .13$, $\eta_p^2 = .01$). No significant 3-way interaction effect was found between training statistics, training implicit gender bias and gender applicant on affirmative action, $F(1,166) = 0.01$, $p = .92$, $\eta_p^2 = .00$.

## Discussion

In the present study the effect of training on gender bias reduction in academia was examined. Two types of training were examined: a training in statistics of the underrepresentation of women in academia and a training in implicit gender bias. Gender bias was measured by three variables: Perceived competence, hireability and proposed salary. Below, the results, implications, suggestions for future research and conclusions will be discussed.

### Does exposure to statistics of the underrepresentation of women in academia lead to less gender bias than no exposure to the statistics?

The results partly support the hypothesis that individuals who have been exposed to statistics illustrating the underrepresentation of women in academia, show less gender bias than individuals who have not been exposed to statistics of the underrepresentation of women in academia.

People who had been exposed to statistics of the underrepresentation of women in academia, evaluated women slightly more competent, than people who were not exposed to these statistics. Most distinct finding was, however, that men were evaluated less competent after people were exposed to statistics of the underrepresentation of women in academia, compared to people who were not exposed to these statistics. The difference in perceived competence between male and female applicants was much bigger after the statistics training than before the training, but afterwards women were evaluated more competent than men instead of men being evaluated more competent than women. Although the training did not reduce the gender gap in perceived competence, it did increase the perceived competence of women.

People who had been exposed to statistics illustrating the underrepresentation of women in academia, did not evaluate women as more hireable and did not propose a higher salary to women, compared to individuals who had not been exposed to these statistics. A possible explanation for this finding could be that by showing the statistics to people they were still able to give their own attribution to the underrepresentation of women in academia. People are mostly unaware of the existence of implicit gender bias and think nowadays men and women have the same career opportunities. Therefore, they might attribute the underrepresentation of women mostly to women's *own choice* to leave their academic career earlier than men, for example due to family reasons. In this case gender bias is not seen as a cause of underrepresentation of women in academia and people will not evaluate female

applicants differently after having seen these statistics. Shen (2013) confirmed in her article that family choices seem to weigh more heavily on the career goals of women than men. This supports the attribution people give to the underrepresentation of women in academia. On the other hand, Hyde (2014) showed that the few differences in psychological variables that exist between male and female are not relevant for an academic career. Women are equally competent as men for an academic career. This information was however not available in the training statistics, so people were not able to consider this information in their evaluation.

**Does exposure to information about implicit gender bias lead to less gender bias than no exposure to this information?**

The results partly support the hypothesis that individuals who have been exposed to information about implicit gender bias, show less gender bias than individuals who have not been exposed this information. People who had been exposed to information about implicit gender bias evaluated women as more competent and hireable than people who had not been exposed to this information. At the same time, men were evaluated less competent and hireable by people who had been exposed to information about implicit gender bias than people who had not been exposed to this information. This result is similar to the result of the training statistics. It suggests that the difference in evaluation between men and women is caused by both underrating women and overrating men. However, with the current findings, we cannot draw any conclusions yet about the size of contribution of the underestimation of women or the overestimation of men to gender bias.

Another possible explanation for the shift in the evaluation of men and women is the phenomenon ‘shifting standards’. Biernat, Manis and Nelson (1991) explain this phenomenon as the implicit use of different judgment standards when evaluating individuals drawn from diverse social categories. They give the example of a physical gender stereotype: “The description "very short" might be reserved for women under 5 feet 2 inches tall, whereas this same statement might be applied to any man who was under, say, 5 feet 6 inches” (Biernat et al., 1991, p. 485). The current results show that women were seen as more sociable, warm and suitable for mentoring. Possibly, when people are unaware of implicit gender bias, they might evaluate the job on more masculine competences, like self-confident and convincing. However, after being aware of implicit gender bias, they might focus more on women. Therefore their anchor of the job function might shift and they evaluate the job on more feminine competences, like sociable, warm and suitable for mentoring. This makes them perceive women as more competent and hireable for the job.

Despite the positive effect of training on the evaluation of female applicants, the results also show that the difference in evaluation between male and female applicants after (both) training(s) is bigger than before training, but the other way around. After implicit gender bias training, the female applicant was evaluated as more competent and more hireable than the male applicant. Although it is desirable that women are evaluated more positively than before, in the end we want men and women to be evaluated equally. So, the results from this study support the idea that information helps to make people aware and change behaviour, but in order to evaluate men and women equally, a training should be developed in which equal evaluation of men and women is more highlighted.

No significant difference in proposed salary was found between people who had been exposed to information about implicit gender bias and people who had not been exposed to this information. Also no significant main effect was found between the female and male applicant in proposed salary. This is not in line with the findings of Moss-Racusin et al. (2012). They found that the female applicant was proposed a lower starting salary than the male applicant. A possible explanation for this could be that the sample of the present study existed for 70.6% of students. It might have been a difficult job for them to determine a proper starting salary, as they had no experience in hiring new employees. This could have influenced the results. The sample of Moss-Racusin et al. (2012) existed of science faculty members, people who were more experienced in hiring new employees. This might have made them more capable of determining a starting salary than students and it might explain the difference in proposed salary between the present findings and those of Moss-Racusin et al. (2012).

**Does exposure to both statistics of the underrepresentation of women in academia and information about implicit gender bias lead to less gender bias than exposure to only one of these trainings?**

The results do not support the hypothesis that individuals who have been exposed to both statistics about the underrepresentation of women in academia and information about implicit gender bias, show less gender bias than individuals who have been exposed to only one of these trainings. This result was found in perceived competence as well as in hireability and proposed salary.

As mentioned above, creating gender bias awareness seems to be more effective in reducing gender bias than showing statistics of the underrepresentation of women in academia. When people have been exposed to information about implicit gender bias,

exposure to statistics about the underrepresentation of women in academia, does not create extra awareness of implicit gender bias. Besides, the statistics training makes it possible to give alternative options for the low percentage of women in higher academic job functions, which does not lead to a reduction of gender bias.

**Implications**

The present findings suggest that if we want to reduce gender bias in academia, we must make people aware of the existence of implicit gender bias. People are still biased and often unaware of the existence of implicit gender bias in academia (Moss-Racusin et al., 2012). Without awareness people are not able to change their behaviour. By explaining them the phenomenon of implicit gender bias and showing them research results of studies about gender bias, awareness will be created, behaviour will be changed and gender bias reduced. An important note to this is that the aim of the training should be equal treatment and evaluation of men and women. As mentioned earlier, it is therefore recommended to add extra information about the importance of equal treatment and evaluation of men and women to the implicit gender bias training. By adding this information the risk of creating a gender gap in which women are evaluated as more competent and hireable than man, will be reduced.

An alternative solution for reducing gender bias is blind job selection (Raymond, 2013). Blind job selection means that when the employer sees the application material for the first time, he/she is not able to see the name or gender of the applicant. This makes employers unable to be gender biased. Off course there will be a second selection round in which the employer will interview the applicant. In that case blind selection is not possible. Blind selection is therefore only a partial solution and it is very important to create awareness about implicit gender bias, by exposing people to information about implicit gender bias. Other alternatives of creating awareness can also be effective: For example discussions or brainstorms about ways to overcome implicit gender bias in academia. It can also be useful to define measurable criteria in advance to avoid a gut response, which is very vulnerable to bias (Raymond, 2013).

**Future Research**

The present study examined the direct effect of training on gender bias reduction. Participants were exposed to a training right before they were asked to evaluate an applicant. This had effect on gender bias reduction. However, what happens when the time between training and evaluation increases? In daily life, the moment people are made aware of information is often not directly followed by the moment they are using this information. The

moment employers are made aware of the existence of implicit gender bias, is often not right before they see (material of) a job applicant. Carnes et al. (2012) found evidence that four to six months after a Bias Literacy Workshop three-quarters of the participants demonstrated increased bias awareness. However, long term effects, such as more equitable hiring, were not analysed yet. Therefore, future research is needed to examine the effect of time on the interaction of training and gender bias reduction.

Another recommendation for future research is to examine the difference in effect of training between male and female evaluators. As Moss-Racusin (2012) pointed out, both men and women show gender bias, but nothing is known yet about the difference in training effect between men and women. Do men and women show the same effect of training on gender bias? In the present study the sample was not big enough to examine this difference between men and women. Besides, the distribution of men and women was not equal across conditions in the current sample. Therefore, future research needs a bigger sample, in order to examine the difference in effect of training between male and female evaluators.

**Conclusions**

In this study we examined the effect of training on gender bias reduction in academia. Showing statistics of the underrepresentation of women in academia slightly reduced gender bias: The perceived competence of women increased, but hireability and proposed salary did not increase. Exposing people to information about implicit gender bias did reduce gender bias. Both perceived competence and hireability of women increased. The training implicit gender bias was more effective in reducing gender bias than the training statistics. Besides, the training statistics did not add any value to the training implicit gender bias in reducing gender bias. These results indicate that creating awareness about implicit gender bias is an important step in reducing gender bias in academia.

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# Appendix A

## Application material (male applicant)

**Demografische gegevens**

Sollicitant#: 83
Naam: Thomas [redacted]
Geslacht: Man
Nationaliteit: Nederlands
Leeftijd: 29
Hoogst afgeronde opleiding: Ph.D. in Social and Organizational Psychology (afgerond in september 2013 aan de Universiteit [redacted]

**Achtergrond**

| | |
|---|---|
| Gemiddelde cijfer Master: | 7,5 |
| Master thesis: | 8,0 |
| Awards/honors: | Facultaire promovendiprijs 2012 |
| Onderzoekservaring: | 4 jaar promotie onderzoek |
| Onderwijservaring: | Werkgroep begeleiding, cursussen gegeven zowel op Bachelor als Master niveau, Master thesis supervisor |
| Aanbevelingsbrieven: | 3, allemaal positief |
| Toekomst plannen: | Ambitie om professor te worden |
| Extracurriculaire activiteiten: | Master-OpleidingsCommissie |

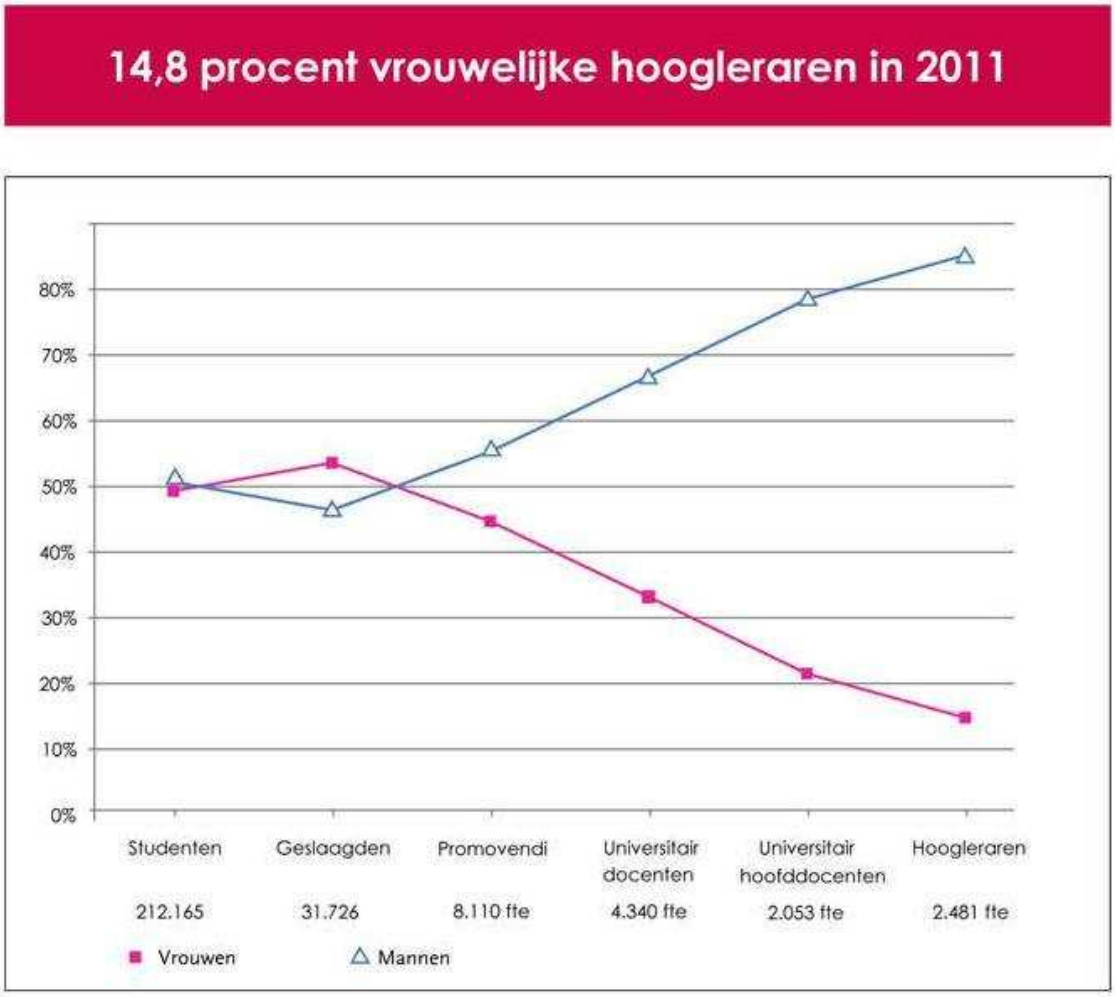
**Brieven**

*Fragmenten uit de brief van de sollicitant:* "Ik ben zeer gemotiveerd en zal deze kans aangrijpen om een goede universitair docent te zijn. Tijdens mijn promotietraject heb ik waardevolle technische onderzoeksvaardigheden opgedaan, diverse artikelen gepubliceerd en les gegeven aan studenten. Ik streef naar een academische carrière en deze functie zou een mooie stap in de goede richting zijn. Daarnaast ben ik erg geïnteresseerd in uw vakgebied. Dit sluit goed aan bij mijn eigen interesses en ervaringen … Kort samengevat, ik ben gefocust, georganiseerd, en wil graag mijn onderzoeksvaardigheden verbeteren. Ik ben erg enthousiast over de mogelijkheid om de rol van universitair docent te vervullen en met u samen te werken."

*Fragmenten uit een aanbevelingsbrief:* "…alhoewel Thomas in het eerste jaar van zijn promotietraject nog zijn weg moest vinden in de academische wereld, heeft hij indruk op me gemaakt in de laatste twee jaar door hard te werken en veel vooruitgang te boeken. Hij is een sterke promovendus geweest op mijn afdeling en ik weet zeker dat hij in staat is om zijn werk als universitair docent goed uit te voeren."

# Appendix B

## Training statistics




**Man-vrouwverdeling bij ingeschreven studenten, geslaagden, promovendi, universitair docenten, universitair hoofddocenten en hoogleraren, ultimo 2011**

Bron studenten en geslaagden: 1cHO2011, oktober 2011, in personen. Exclusief wetenschapsgebied *Gezondheid*
Bron personeel: VSNU, WOPI, ultimo 2011, in fte. Exclusief wetenschapsgebied *Gezondheid*.

# Appendix C

## Training genderbias

Vrouwen ondervinden nog steeds hinder van impliciete gender vooroordelen. Als gevolg van cultureel bepaalde stereotyperingen heeft vrijwel iedereen vooroordelen. Deze vooroordelen kunnen leiden tot het onbewust verkeerd beoordelen van mensen. Dit wordt impliciete bias genoemd; het is een geautomatiseerd en onbewust proces. Deze bias is ook van toepassing op het beoordelen van mannen en vrouwen. In dit geval wordt het impliciete gender bias genoemd. Ook mensen die geloven in gelijkheid van mannen en vrouwen, laten vaak onbewuste gender bias zien. Hierdoor hebben vrouwen nog altijd minder goede kansen op de arbeidsmarkt dan mannen, wat zich onder andere uit in een lager salaris voor dezelfde functie. Sommige mensen denken dat deze bias voortkomt uit daadwerkelijk verschillen tussen de vaardigheden en competenties van mannen en vrouwen. Onderzoek heeft echter aangetoond dat er nagenoeg géén verschillen zijn (Hyde, 2014). Mannen en vrouwen zijn gemiddeld genomen even competent en ambitieus. Biologische verschillen die er wel zijn tussen mannen en vrouwen hebben geen betrekking op ambities en competenties.

Ondanks dat mannen en vrouwen objectief gezien niet verschillen in hun competenties, blijkt uit onderzoek naar impliciete gender bias echter dat mannen als meer competent gezien worden dan vrouwen (zelfs wanneer zij dus even competent zijn; Moss-Racusin et al., 2012). Daarnaast blijkt uit onderzoek dat, als gevolg van impliciete gender bias, vrouwen beter en meer moeten presteren dan mannen om als even competent beoordeeld te worden (Foschi, 2000). Deze onderzoeken laten dus zien dat impliciete gender bias nog steeds veel voorkomt. Dit is niet alleen een probleem voor vrouwen, maar ook voor de maatschappij als geheel, omdat veel talent op deze manier onbenut blijft.