



Yan, MA (2020) *How can knowledge about female scientists affect gender equality support, confidence and interest in science in both women and men?* [MSc].

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[How can knowledge about female scientists affect gender equality support, confidence and interest in science in both women and men?]

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Abstract

Although gender inequality has long been an issue in the domain of science, relatively few studies have examined the effects of knowledge of gender discrimination in this area on both women's and men's confidence and gender equality support. The present research aimed to investigate how different levels of gender discrimination information against female scientists affect men and women in terms of their interest and self-efficacy in science as well as the willingness to support gender equality policies. A total of 145 adult participants (Male=52, Female=93), with the age ranging from 18 to 68 ($M=33.81$, $SD=11.88$), participated in an online survey. Those respondents were randomly assigned to one of three conditions (high discrimination, mitigated discrimination and control). Pearson correlation coefficients indicated that for both women and men, the more they perceived discrimination and unfairness against female scientists, the more they perceived privilege of men over women, the more they experienced anger and had more willingness to support gender equality. ANOVA analyses demonstrated that 1) there was no significant effects of three conditions of gender discrimination on interest and self-efficacy in science; 2) women were more likely to support gender equality than their male counterparts while no significant effect of three levels of gender discrimination was found. In addition, it was also found that in mitigated discrimination condition, women and men had a lower stereotype of men competence. Potential implications for promoting gender equality are discussed.

Key words: gender discrimination, female scientists, gender equality, science interest, self-efficacy

How can knowledge about female scientists affect gender equality support, confidence and interest in science in both women and men?

This year marks 100th anniversary of the birth of Rosalind Franklin, a pioneering British female chemist who played a key role in discovering DNA (Genomics England, 2020). However, her contribution was historically overlooked due to gender, which reveals that gender discrimination has long been a major issue in the domain of science (Ip, 2008). Similarly, 43 years ago, Jocelyn Bell Burnell, a female astronomer, found pulsars, which led to the Nobel Prize in physics in 1974. However, the prize went to her male supervisor and colleague instead of her. As was conveyed in an interview with Bell Burnell, people at that time held the belief that where science was undertaken lied a man(Lee, 2013). What was also commonplace then was heavy underrepresentation of women in the scientific fields from primary and tertiary education to the workplace (Smyth & Nosek,2015). For example, in 1966, only 7% of Bachelor's degrees were awarded to women in Science, Technology, Engineering and Math(STEM; National Centre for Science and Engineering Statistics, 2011).

It is undeniable that recent years have witnessed a plethora of efforts made by academics and policymakers to tackle gender inequality, including intervening recruitment policy to improve women's and girl's access and enrolment in science, appointing more female scientists in the higher level position in the research institutions and narrowing wage gap (Ip, 2011; Potvin et al., 2018; Schiebinger, 2010). Nevertheless, the situation has not improved much considering women still trail their male counterparts in the sphere of science in many aspects around the world. To illustrate it more clearly, in 2016, women constituted less than one third of those participating scientific research and development globally (UNESCO Institute for Statistics, 2019). In terms of education, women in India were still underrepresented, with 31.4% receiving undergraduate degrees of engineering and technology majors in 2018-2019 while 15.4% of engineering undergraduate degrees were

awarded to Japanese women in 2019 (Ministry of Human Resource Development, 2018; Gender Equality Bureau Cabinet Office, 2020). Meanwhile, in Europe, women's share of Bachelor's Degrees was 19.8% in information and communication technologies and 26.7% in engineering in 2018 (Eurostat, 2020). In the workplace, in Australia, over the past 10 years, the representation of women working in scientific fields has barely increased from 11% in 2009 to 14% in 2019 (Department of Industry, Science, Energy and Resources, 2020). Women represented 23.6% in natural and applied sciences in Canada at the same year where women earned 76% of that of their male counterparts (Statistics Canada, 2020). In the United States, women working in computer, engineering and science received around 80.7% of men's annual median earnings (US Census Bureau, 2020). As for the career advancement, in the information technology industry, women on boards only represented 17.9% in 2019 (Emelianova & Milhomem, 2019). Furthermore, since 1901 when the first Nobel Prizes were awarded, there were only 20 women out of 688 Nobel laureates in the fields of Physics, Medicine, Economics and Chemistry till 2018 (Lunnemann et al., 2019).

The status quo pertaining to gender inequality in science may have many implications for the benefit of our society (Blickenstaff, 2005; Schiebinger, 2010). For starter, lack of female role models and leaders in scientific fields will discourage women and girls from entering the fields and progressing to leadership positions (Eagly et al., 2003; Ip, 2011; Thoman & Sansone, 2016). This will give rise to further dearth of women because intelligent and talented females who may make contributions to the field may turn to other jobs or sectors due to underrepresentation and lack of promotion (Blickenstaff, 2005). Similarly, previous research showed that female were more inclined to exit from the scientific fields where there was lower percentages of women (Hunt, 2016). Besides, it is a hindrance to the advancement of science since women can bring diverse perspectives in the pursuit of knowledge during scientific undertaking (Blickenstaff, 2005; Lee, 2013). Furthermore,

gender inequality is a potential detriment to the economy and according to European Institute for Gender Equality(2017), if gender equality is achieved in the education of STEM fields by 2050, it is expected that there are 1.2 million more jobs and that Europe's GDP increases by 610 billion euros. Moreover, exclusion of women in scientific fields is a loss of talent and skilled labour especially in the developing world where women accumulate knowledge of food production and medicine due to gender roles (Schiebinger, 2010).

Although reasons of gender disparity in the scientific sphere are complex, gender discrimination plays a significant role (Weisgram & Bigler, 2007). Existing research indicated that such discrimination may undermine women's science self-efficacy and interest, thus discouraging them from participating in scientific fields(Major et al., 2003; Rosenthal et al. 2007; Smith et al. 2013; Stout et al., 2011). In contrast, other studies found that the knowledge of gender discrimination could increase girls' self-efficacy, which should further enhance interest in the same domain (Farmer et al., 1999; Weisgram & Bigler, 2007). This may be because girls reinterpreted their past negative feedback and attributed it to discrimination instead of lack of competence(Crocker & Major, 1989). Despite the divergent results, those studies indicated that the information of gender discrimination could have influences on self-efficacy and interest in science and is an area worth exploring to boost positive attitudes and confidence in science.

In addition, with the improved awareness of gender equality and prevalence of media, many women in different fields who used to be behind the scenes are made known to the public in a variety of forms. For example, *Hidden Figures*, a biographical film, made public the contributions of three female mathematicians working in National Aeronautics and Space Administration (NASA) during Space Race(" Hidden Figures", 2020). In other words, some women received acknowledgements for their contributions later, including Rosalind Franklin and Jocelyn Bell Burnell who were mentioned earlier. However, when reporting the stories of

those female scientists, some focused on the past gender discrimination(Lee, 2013) while others highlighted their achievements and late acknowledgements (Genomics England, 2020). For example, on July 25, 2020, the 100th birthday of Rosalind Franklin, instead of stressing gender discrimination, her contributions were celebrated and highlighted in terms of what great influences on medicine and humankind that her discovery had, which may inspire young women to follow in her footsteps in scientific fields(Genomics England, 2020).

Different presentations may elicit different reactions, which leads to a question: which way is better to present the stories of female scientists about gender discrimination to make a positive change in both women and men in terms of their interest and self-efficacy in science, just focusing on gender discrimination or highlighting their late acknowledgements?

Therefore, the first aim of the research was to investigate how the knowledge of gender discrimination and late acknowledgements in science will have effects on both women's and men's interest and self-efficacy in science.

What gender inequality also reveals is that men as the advantaged group are privileged against women, the disadvantaged group(Wright, 2001). According to social identity theory(Tajfel & Turner, 1979) and intergroup emotion theory(Smith,1993), members in the disadvantaged group who perceive discrimination or unfairness tend to experience group-based emotions and are likely to take action against the inequality. For example, minority groups in the United States took action to defend their civil rights and women mainly endeavoured to expand their rights in different fields (Tilly, 2004). However, although group membership of advantaged groups provides members with unearned privileges, when members consider the privileges unfair, they may also have affective reactions and have a tendency to act to seek equality (Leach et al., 2002; Leach et al., 2006;Schmitt, 2000). For example, European Americans who perceived their ingroup more unfairly privileged tended to ask the government to redress the situation to a greater extent

(Iyer et al., 2003; Swim & Miller, 1999). However, previous research mainly focused on either the advantaged group or disadvantaged group and no studies have been carried out to our knowledge on this specific topic of gender discrimination in science (Leach et al., 2006; Shepherd et al., 2018; Weisgram & Bigler, 2007) . Hence, at an intergroup level, this research aimed to explore what effects that different knowledge of gender discrimination have on both female and male public in terms of perceived privilege of men over women, affective reactions and the willingness of supporting gender equality policy.

However, social identity tradition has argued that group members do not respond to social inequality in the same way (Iyer & Ryan, 2009). Although some people perceive discrimination and unfairness from inequality, some others attribute the success of the advantaged groups to high competence due to stereotypes and thus legitimate the inequality (Fiske et al., 2002; Leach et al., 2007; Judd et al., 2005). In the context of gender inequality, such stereotypes may influence evaluations towards two groups and lead to gender discrimination, which will further enhance the gender stereotypes and contribute to a vicious circle(Heilman, 2002). However, there is not much literature to our knowledge that have examined how exposure to gender discrimination of females scientists can affect women's and men's attitudes towards science and reinforcement of traditional stereotypes of competence associated men and women. Therefore, another aim of this research was to investigate how different knowledge of gender discrimination affect women's and men's stereotypes of competence associated with women and men.

Literature Review

Science interest and self-efficacy

Previous research indicated that interest is a source of intrinsic motivation and can serve as a predictor of career choice (Holland, 1997; Su & Rounds, 2015). This is consistent with existing studies which found that gender discrepancy in science are mainly attributed to

differences in motivation even they do well in science courses (Leaper & Starr, 2019). In a study interviewing females who left science, one major reason identified was lack or loss of interest in the scientific fields (Seymour & Hewitt, 1977). Besides, in a longitudinal study, women who changed major from science to other fields had lower self-efficacy ratings than male students even though they had same GPA. Furthermore, according to expectancy-value model, individuals' competence (i.e., self-efficacy) and task value (i.e., interest) of certain fields play a role in making achievement-role choices (Eccles & Wigfield, 2002). This means people are more motivated to pursue career in science if they believe in their competence and have interest in this area (Eccles & Wang, 2016; Watt, 2008). This was also in line with social cognitive career theory (Lent et al., 1994) which indicated that self-efficacy has direct effects on career choice through interest and expectations of outcomes. In other words, the interest and self-efficacy in science is a key factor in determining whether women enter and stay in this field (Lent et al., 2001; Thoman & Sansone, 2016).

However, stereotype threat, which means a concern experienced when stigmatized group members consider themselves at a risk of confirming negative stereotypes of their group, is a barrier to women's interest in choosing science as career (Deemer et al., 2014; Steele, 1997). Specifically, science-related gender stereotypes which suggests women are not as competent as men and that women does not belong to science may undermine women's performance in science, decrease interest and self-efficacy in this area and thus affect their motivation to pursue scientific majors and careers (Robnett, 2016; Moss-Racusin, et al., 2018). This further leads to enhancing negative stereotypes and gender discrimination against women (Heilman, 2002). However, the results of previous studies on the effect of gender discrimination on interest and self-efficacy in science was not consistent.

Some studies indicated that the perception of gender discrimination will undermine science interest and self-efficacy (Major et al., 1998; Sansone & Thoman, 2005). Empirical

evidence indicated that such negative effects that gender discrimination had are across ages regions. For example, studies conducted in the United States, Germany and Israel indicated that adolescent girls who heard negative or sexist comments about girls in science subjects showed less motivation and achievement(Boehnke, 2008; Kessels, 2005; Leaper & Brown, 2008). Besides, among undergraduate samples, research suggested in male-dominated fields (science), women was more likely to be confronted with gender discrimination than female-dominated areas(arts, humanities) and thus had lower interest and considered switching their major(Steele et al., 2002; Robnett, 2016). Consistently, Leaper and Starr (2019) found that negative messages against the girls in science from instructors and peers can impair females' interest.

Nevertheless, this was not always the case: the knowledge of gender discrimination may have positive influences on the interest and self-efficacy in science. For example, children who used to attribute gender differences to men's superiority and more achievements in science would believe women are equally capable after they learn gender discrimination (Weisgram & Bigler, 2006). In another study examining the effect of knowledge of gender discrimination on girls, 62 participants were assigned to discrimination condition where girls attended three 1-hour sessions to listen to presentations by female scientists about their career and 1-hour session about gender discrimination in scientific fields while 96 girls were assigned to standard condition in which participants listened to four 1-hour sessions about presenters' career in science. The result showed an increase of self-efficacy in science in the discrimination condition (Weisgram & Bigler, 2006). This may be because girls may have ascribed their past negative feedback of their performance to discrimination instead of their lack of competence and thus boost their self-efficacy(Crocker & Major, 1989). In addition, the knowledge that women as disadvantaged group struggled to make achievements in science was a source of pride that can boost girls' self-efficacy(Weisgram & Bigler, 2007).

However, it is worth noting that those studies mainly focused on girl school students and little work has been done to examine how the knowledge of gender discrimination in science affect both adult men and women. According to career development model proposed by Astin (1984), individuals' expectations and aspirations towards career may be altered if they perceive that discrimination in the workplace affects the opportunities available to them. In other words, the information of gender discrimination in science would decrease females' interest in science. Nevertheless, this expectation was also contradicted by other literature which indicated that knowing gender discrimination would make females consider science a worthwhile occupation to pursue (McGrayne, 2001). Besides, little prior research has examined how the information of gender discrimination affected men's interest and self-efficacy in science. Therefore, it is worth it to investigate the effect of knowledge of gender discrimination on both adult men and women.

APPRAISALS OF INTERGROUP RELATIONS

The social identity theory (Tajfel & Turner, 1986) and self-categorization theory (Turner et al., 1987) provides an explanation of how individuals identify themselves as members of groups and see the world from the perspective of group members. When an individual perceive that they are a member of a group and witness that one group receives unjust or unfair treatment such as discrimination, they may experience emotional reaction and have some behavioural tendency to mitigate injustice whether they are members of the advantaged group or disadvantaged group. (Leach et al., 2002; Leach et at., 2006; Wright, 2001).

However, although social inequality is a widely acknowledged issue, individuals who are members from the advantaged group may not perceive their privilege or take advantage for granted (Leach et at., 2006). For example, when individuals do not count them as a member of the advantaged, they are less likely to perceive the existence of ingroup privilege

(Leach et al., 2011). Besides, under certain circumstance, the advantaged group may be considered as the norm and see the gap between the advantaged and the disadvantaged as a difference rather than inequality, which makes privilege invisible (Leach et al., 2011). Therefore, the relationships between perceived discrimination, perceived unfairness, perceived ingroup privileges, affective emotions and the willingness to support gender equality needs to be done in the field of gender discrimination in science.

The emotion-action link

According to Intergroup Emotions Theory, self-categorization may lead to the fact that group members experience emotions based on group membership (Gordijn, 2001). Prior research has shown that a variety of emotions may arise when individuals perceive their ingroup unfairly advantaged, such as guilt, sympathy and anger (Leach et al., 2001). Similarly, individuals who belong to the disadvantaged group and perceive their group is disadvantaged experience anger and tend to fight for equality (Walker & Mann, 1987). Those emotions about intergroup inequality may indicate the willingness to do something to alleviate inequality, such as collective protests and demonstrations (Hatch et al., 2008). However, existing research showed although each emotional experience of intergroup inequality has implications for behavioural tendencies, they are not equivalently efficacious in promoting actions (Glasford, 2013; Hatch et al., 2008). Therefore, in order to better promote gender equality policies, it is important to identify which emotion can best predict the willingness to take specific actions.

Guilt and sympathy

Prior research showed that guilt may motivate the advantaged group to promote equality, but such efforts are barely real actions, but more related to abstract goals, such as making an apology or demanding for material compensations (Leach et al., 2001). In a study examining whether guilt could predict both abstract goals and specific political action, the

results showed guilt was a weak predictor of the willingness to take specific action (Leach et al., 2006). Therefore, guilt was not an appropriate predictor of the willingness to take specific actions to support gender equality.

Sympathy is an emotional reaction that individuals may experience when they identify with the disadvantaged's misfortune rather than perceive the wrongdoing or injustice of the advantaged group (Leach et al., 2001). Although sympathy may elicit helping behaviours that aim to improve the situation of the disadvantaged, there was a weak association between sympathy and behavioural intentions (Iyer et al., 2003; Schmitt et al., 2000). Therefore, although sympathy is considered as a prosocial emotion, it may be not capable of predicting specific actions to promote gender equality.

Anger

Previous work has indicated that the primary emotion triggered by discrimination is anger, especially when the situation is considered as unjust (Crocker & Major, 1994; Mackie, 2008). Although anger and sympathy can be both experienced, existing work suggested that the appraisal of group privilege were linked to anger instead of sympathy, which suggested that anger should be a strong predictor of participating in actions (Iyer & Ryan, 2009). In other words, when individuals experienced anger due to unjust treatment from outgroup, anger will elicit actions on behalf of the group (Mackie, 2008). Meanwhile, when individuals perceive their ingroup has done wrong, they also experience anger and are more likely to engage in support on behalf of out-group (Glasford, 2013). However, previous research mainly investigated either the advantaged group (Doosje et al., 1998; Leach et al., 2006; Harth, Kessler & Leach, 2008) or the disadvantaged group (van Zomeren et al., 2008) and little research has been done in the context of gender discrimination in science. More research should be done to examine the effect on both women and men in the area of gender discrimination in science.

The stereotypes of women's and men's competence

In the scientific field, competence is stereotypically attributed to men, suggesting that women lack ability in science and producing less interest and worse performances than man (Denissen et al., 2007; March et al., 2005). Such stereotypes may result in gender discrimination (López-Sáez & Lisbona; 2009). For example, existing research has found that stereotypes about men and women have negative impact on the career selection and career advancement of female faculty (Rogus-Pulia et al., 2018; Zebrowitz et al., 1991). It is also worth noting that discrimination still exists even if it is unintentional due to gender stereotypes (Dovidio et al., 2002; Filut et al., 2017).

Considering people may attribute gender inequality to stereotypical competence instead of gender discrimination, it is important to take stereotypes of women's and men's competence into account when assessing the effect of knowledge of gender discrimination. However, little existing studies have examined this. Furthermore, no previous research has examined how late acknowledgments of women's contributions affect the way men and women perceive men's and women's competence.

Overview of the present study

No prior research to our knowledge has investigated how different levels of gender discrimination in scientific field affect gender equality support, self-efficacy and interest in science in both adult women and men. Although much work has been done to examine the effect of the knowledge of gender discrimination, most of them mainly focused on only women and girl students and no work has taken into account the effect of late acknowledgements where female scientists were recognized by late or post-mortem awards. Besides, many previous research ignored the link between perception of unfairness, privilege, emotions and action tendencies to tackle gender inequality, combined with the effects on interest and self-efficacy in science. Therefore, in this study, the researchers sought to

advance the literature by examining how different levels of knowledge of gender discrimination can affect perceived privilege, experienced anger, support for gender equality and interest and self-efficacy in science from the perspectives of both men (the advantaged group) and women (the disadvantaged group). To achieve this, the study conducted the research through an online survey and created three levels of gender discrimination to manipulate group members' sense of unfairness, including high discrimination, mitigated discrimination by late acknowledgements and control condition with no discrimination information. This study also investigate dhow the knowledge of gender discrimination affect the stereotypical traits of competence associated with women and men. Besides, gender identification was also measured and controlled.

Considering the existing literature , the hypotheses are as follows:

Hypothesis 1: for both women and men, the more perceived discrimination and unfairness of female scientists, the more perceived privilege of men over women, the more intergroup anger and the willingness to support gender equality polices.

Hypothesis 2: exposure to different levels of gender discrimination of female scientists (high discrimination, mitigated discrimination and no discrimination) would affect

a) women's and men's science interest and self-efficacy in science;

b) women's and men's willingness to support gender equality;

c) women's and men's stereotypes of competence associated with men and women.

Methods

This study aims to explore 1) how different levels of gender discrimination in scientific fields affects women's and men's interest and self-efficacy in science; 2) what effects that the knowledge of gender discrimination in science have on female and male public in terms of appraisals of intergroup relations(discrimination, unfairness and privilege),

anger and the willingness to support gender equality policy, and stereotypical traits (competence) linked to women and men.

Design

The current study presented a 3 (three conditions: high discrimination, mitigated discrimination, control) x 2 (gender: female and male) between-participants experimental design. Given research question one, the dependent variables were interest and self-efficacy in science.. Regarding research question two, the dependent variables were perceived discrimination against female scientists, perceived unfairness of female scientists, perceived privilege of men over women, anger, the willingness to support for gender equalities and the stereotypes of women's and men's competence. Gender identification served as a variable to be tested and controlled.

The design of this research was approved by the School of Education Ethics Committee of University of Glasgow (Appendix A). The topic of the experiment might cause stress or other unpleasant feelings, especially under the special circumstances of Covid-19; therefore, several psychological support resources were provided in the Participants Information Sheet (PIS; Appendix B) to minimize any potential risks of taking the survey.

Participants

Participants were recruited using several strategies: a link posted on social media groups such as Facebook and Twitter; Surveyswap and Surveycircle, two websites where researchers could collect data by exchanging surveys; a recruitment poster (Appendix C). The selection criteria was adults with an intermediate level of English. The ethnicity and nationality were not restricted because gender equality is a widespread issue.

A total of 165 participants completed the survey but since the experiment targeted women and men, 6 participants who identified themselves as non-binary were removed. A further manipulation check was made to check whether participants understood the condition

which they were assigned to and 14 participants who failed to do so were also removed. The final sample consisted of 145 participants (Male=52, Female=93) with age ranging from 18 to 68 ($M=33.81$, $SD=11.88$). In terms of demographic information, 45.3% participants received Master's Degree and 33.3% participants had Bachelor's Degree. As for the ethnicity, 62.3% participants identified them as White and 25.8 identified them as Asian. When asked about the involvement of science in their occupation, 50% of male respondents and 62% of female respondents reported that science was moderately or highly involved.

Stimulus Material

Participants were randomly assigned to one out of three conditions and presented with a vignette about three female scientists.

High discrimination condition. it was explicitly pointed out that three female scientists did not receive Nobel Prize in spite of their extraordinary contributions and the prize went to their male colleagues or supervisors instead.

Mitigated discrimination condition. it was explicitly stated that although female scientists did not received the Nobel Prize, they received late or post-mortem awards.

Control condition. no information was provided as to the awards but description of what contributions these three female scientists made to the scientific fields.

The Nobel Prize was taken as context because it is well-known and one of the major symbols of distinction in science. Although some women won the Nobel Prize, the majority are in literature or peace rather than science. In other words, it is a remarkable sign of discrimination that women made great contributions but the prize went to their male colleagues.

These three female scientists were selected based on several considerations. First, they were in the scientific fields, namely Physics, Chemistry and Astrology. Secondly, although they did not receive the Nobel Prize, they were acknowledged later, so we can use

this information for the mitigated discrimination condition. Thirdly, they were all white, so we could keep the ethnicity of both male and female scientists constant to make sure that the only salient characteristic was gender.

The scenarios were made with balanced number of words (around 265 words). The first part in three conditions was identical basic information about three female scientists. For example, the information of one scientist was as follows:

The Austrian physicist Lise Meitner (1878-1968, Vienna) discovered with her colleagues, the scientists Otto Hahn and Otto Robert Frisch, the nuclear fission of uranium, which is the basis of the development of nuclear weapons and electricity production.

The second part was different levels of gender discrimination information as to whether these female scientists received award or not. For example, the manipulation for the high discrimination condition was as follows:

Although Meitner strictly collaborated and contributed to this extraordinary discovery, in 1944 the Nobel Peace in Chemistry was given exclusively to her fellow scientist Hahn, who was credited for having discovered nuclear fission.

The example of the manipulation for the mitigated discrimination condition was as follows:

Although she was not given a Nobel Prize for this discovery, which went exclusively to her fellow scientist Hahn, Meitner was the first woman to be assigned a professorial title in Germany and had many awards later in her career.

The example of manipulation for the control condition was as follows:

The discovery of the nuclear fission of uranium was important because it showed how the uranium nucleus can be split in two and if this fission reaction emits enough

secondary neutrons, a chain reaction can occur and release an extraordinary amount of energy.

All the information was retrieved from Wikipedia and other reliable websites on science and gender equality rights.

Measures

Manipulation check. For each scientist, there were two multiple choice questions to check whether participants read stories carefully and understood the condition. The first question was to check whether participants remembered the contributions that each female scientist made and the second one was to check whether participants understood that none of the three female scientists received the Nobel Prize despite their contributions.

Perceived discrimination against female scientists. To measure to what extent the participants perceived discrimination, we posed a single item for each scientist ($\alpha=0.81$): ‘If she didn’t, how much do you agree that this was because of gender discrimination?’ The responses were given on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly).

Perceived unfairness towards female scientists. To measure to what extent the participants perceived unfairness, we posed a single item for each scientist ($\alpha=0.81$), for example ‘How fairly do you think that Rosalind Franklin has been awarded for her scientific achievements?’ The responses were given on a 5-point scale ranging from 1 (completely unfairly) to 5 (completely fairly).

Interest and self-efficacy in science. To measure whether gender discrimination have effects on people’s interest and self-efficacy in science, we adapted the School Science Attitudes Survey (Kennedy et al., 2006) to measure participants’ multifaceted attitudes towards the domain of science. Since our study aimed at adults, we removed questions related to school activities and courses and replaced questions related to students’ everyday life and usefulness for students’ career with questions related to the society and willingness to choose

science as a career. Therefore, the final version was 30 questions on a 7-point Likert-type scale from 1 (completely disagree) to 7 (completely agree) to explore attitudes. In this study, in order to understand interest and self-efficacy in science, it was grouped into two sub-scales and Cronbach alpha was checked: science self-efficacy (17 items, $\alpha=0.92$) and science interest(13 items, $\alpha=0.87$).

Perceived privilege of men over women. There were 5 items, 4 of which were adapted and 1 was added. To measure how participants perceived men privilege over women, we adopted items of Swim and Miller's (Swim & Miller, 1999) scale of perceived ingroup privilege which referred to White Americans. In this study, we adapted 4 items to the gender context by replacing references to White Americans with reference to women($\alpha=0.88$). In this case, the scale assessed to what extent men and women perceived that men received more privileges than women due to gender through 4 questions. An example was "I do not feel that MEN have any benefits or privileges due to their gender". Besides, we also added a single item that asked participants whether males and females are advantaged in the scientific field: "Do you think WOMEN are advantaged, compared to MEN in scientific areas?". Participants rated their responses on a 7-point Likert-type scale from 1 (disagree strongly) and 7 (agree strongly).

Intergroup Anger. 5 items were used to measure anger, which was an emotion felt when injustice occurs in an intergroup context instead of at an interpersonal level. We employed different emotion terms: anger, offense, irritation and madness, most of which were adapted from Leach et al.(2007). The original context was Aboriginal and Non-aboriginal groups and we adapted it to gender context. One example was ' It offends me that WOMEN are not treated as well as MEN in our country'. Participants were required to rate the degree to which they felt on a 7-point Likert-type scale from 1 (strongly disagree) to 7

(strongly agree). However, based on Cronbach alpha, only the first 3 items ($\alpha=0.81$) were measured to effectively examine the role of intergroup anger.

Willingness to support gender equality. There were 10 items that were adapted from Leach et al.(2006) which assessed the behavioural tendency to take specific actions($\alpha=0.93$), such as ‘ help organize a demonstration for gender equality’. The response was a on 7-point Likert-type scale from 1 (very unwilling) to 7 (very willing).

Gender Identification. Degrees of identification with gender was measured through 6 items, which was adapted from the Political Ingroup Identification Scale (Pacilli et al., 2016). The original questionnaire was under political context to measure identification with left-wingers or right-wingers. Here we adapted it to gender context. An example was :‘It is important for me to be a woman/man’. Answers were presented with 5-point scales from 1 (completely disagree) to 5 (completely agree). However, data analysis displayed that the Cronbach alpha was too low for the scale. Therefore, only the first item was measured.

Gender stereotypes. Gender stereotypes were assessed by adapting 9 items from Leach et al.(2007). Participants were presented 9 stereotypical traits for men and women respectively: three were related to group morality, three to group sociability, and three to group competence. The answers were assessed on a 7-point scale ranging from 1 (very unimportant) to 7 (very important). However, this research only focused on competence (3 items:‘ competent’, ‘intelligent’, and ‘skilled’. $\alpha=0.85$).

Procedure

The study was conducted through Qualtrics, a GDPR-compliant (General Data Protection Regulation) online survey tool. This online survey platform was chosen because of its randomisation function which assigned participants to one condition randomly and evenly.

Once participants accessed the online survey via a link, the plain language statement, consent form (Appendix D) and questionnaire were provided for the participant. In the plain

language statement, the participants were told the purpose of the study and their rights. After signing consent form, they were presented with questions about demographic information, such as age, education, ethnicity and so on. Next, each participant was randomly assigned to one of three conditions: high discrimination(Appendix E), mitigated discrimination(Appendix F), control(Appendix G). After reading the vignette, participants were asked to answer a series of questions measuring interest and self-efficacy in science, perceived gender privilege, anger, the willingness to support for gender equalities, gender identification, perceived distance. At the end of the survey, participants were asked again if they agreed to have their data to be retained in this data collection or not, and they were thanked for their participation. After they agreed to submit the survey, participants were debriefed by the subsequent page.

Results

A total of 165 participants completed the survey. However, six participants who identified themselves as non-binary or preferred not to say were removed. Besides, 14 participants who did not fully understand the condition of high discrimination and mitigated discrimination were removed based on manipulation check questions. Therefore, the data of 145 participants were analysed. No outliers were found based on violin-boxplots. All the analysis was done in R, a programming language for statistical computing and graphics(R Core Team, 2016).

Before Pearson's correlation coefficient and analysis of variance (ANOVA) were conducted, assumption checks were conducted to check whether data collected in this study met parametric assumption. Firstly, normality check by skewness, kurtosis and z-score statistics was conducted on the female group and male group respectively. The results indicated values of skewness for all measures were between -2 and +2 and the z-score was between -1.96 and +1.96, which can prove normal univariate distribution (George & Mallery, 2010). Besides, the QQ-plots also checked that each measure was normally distributed.

Scatterplots showed the measures met linearity and homoscedasticity. In addition, the results of Levene's tests on all measures indicated that homogeneity of variance was met. Besides, the sample size was over 100 and the number of participants in each condition was not extremely imbalanced; therefore, it was appropriate to employ parametric tests in this research(De Vaus, 2002).

The relationships between appraisals of intergroup relations, anger and gender equality support in women and men

Table 1

Correlations between all measures for women

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9
1. Science Interest	5.33	0.87									
2. Science Self-efficacy	4.79	0.91	.49**								
3. Gender Identification ^a	3.77	1.10	-.08	-.14							
4. Stereotype of women competence	4.98	1.73	.00	.16	.16						
5. Stereotype of men competence	3.93	0.90	-.21*	.14	.09	.42**					
6. Perceived discrimination against female scientists ^a	4.10	0.79	.18	.04	.15	.16	-.01				
7. Perceived unfairness of female scientists ^a	3.88	0.85	.12	-.01	.06	-.06	-.14	.53**			
8. Perceived privilege of men over women	5.51	1.05	.16	.04	.13	.05	-.19	.43**	.33**		
9. Intergroup anger	5.63	1.16	.11	.00	.19	-.01	-.30**	.49**	.32**	.71**	
10. Willingness to support gender equality	5.42	1.23	.27**	.10	.20	.02	-.26*	.45**	.27**	.55**	.67**

Note.

^a Rated on a 1-5 response scale

* $p < .05$. ** $p < .01$

Pearson correlations were conducted to analyze the relationship between all measures in the women and men group respectively in relation to the research question. To test

hypothesis 1, the researchers focused on the relationship between perceived discrimination and perceived unfairness towards female scientists, perceived privilege of men over women, intergroup anger and the willingness to support gender equality policies in both men and women respectively.

As described in Table 1, in the women group, perceived discrimination against female scientists ($M= 4.10$, $SD= 0.79$) was moderately, significantly and positively correlated with perceived unfairness towards female scientists ($M= 3.88$, $SD= 0.85$, $r(91)= .53$, $p< .01$). We also found a moderate, significant and positive correlation between perceived discrimination against female scientists and perceived privilege of men over women ($M=5.51$, $SD=1.05$, $r(91)= .43$, $p< .01$), anger ($M=5.63$, $SD=1.16$, $r(91)= .49$, $p< .01$) and the willingness to support gender equality policies ($M=5.42$, $SD=1.23$, $r(91)= .45$, $p< .01$). Besides, there was a weak correlation ($r(91)= .32$, $p< .01$) between perceived unfairness ($M= 3.88$, $SD= 0.85$) and anger ($M= 5.63$, $SD= 1.16$). In addition, a strong, significant and positive correlation ($r(91)= .71$, $p< .01$) was found between perceived privilege ($M= 5.51$, $SD=1.05$) and anger ($M=5.63$, $SD=1.16$). There was also a moderate, significant and positive correlation ($r(91)= .55$, $p< .01$) between perceived privilege ($M= 5.51$, $SD= 1.05$) and the gender equality support ($M= 5.42$, $SD= 1.23$). Furthermore, anger ($M= 5.63$, $SD= 1.16$) was strongly, significantly and positively correlated with the willingness for supporting gender equality policy ($M=5.42$, $SD=1.23$, $r(91)= .55$, $p< .01$). Those results indicated that for women, the more perceived discrimination and unfairness towards females scientists, the more perceived privilege of men over women, the more intergroup anger against discrimination and willingness to support gender equality polices.

Table 2

Correlations between all measures for men

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9
1. Science Interest	5.48	0.81									
2. Science Self-efficacy	4.87	0.92	.68**								
3. Gender Identification ^a	3.31	1.08	-.16	-.19							
4. Stereotype of men competence	4.12	0.78	.19	.28*	-.08						
5. Stereotype of women competence	4.90	1.73	-.07	-.06	.06	.57**					
6. Perceived discrimination against female scientists ^a	3.72	1.11	.30*	.28*	-.09	.16	.06				
7. Perceived unfairness of female scientists ^a	3.94	0.86	.27	.27*	-.08	.25	.19	.49**			
8. Perceived privilege of men over women	4.55	1.22	.22	.26	-.10	.18	.13	.50**	.36**		
9. Intergroup anger	5.14	1.19	.41**	.29*	-.20	.36**	.10	.60**	.34*	.56**	
10. Willingness to support gender equality	4.61	1.37	.30*	.20	-.11	.05	.02	.44**	.37**	.30**	.50**

Note.

^a Rated on a 1-5 response scale

* $p < .05$. ** $p < .01$

In the male group, as was shown in Table 2, there was a moderate, significant and positive correlation ($r(50) = .49, p < .01$) between perceived discrimination against female scientists ($M = 3.72, SD = 1.11$) and unfairness ($M = 2.06, SD = 0.86$). We also found a moderate, significant and positive correlation ($r(50) = 0.50, p < .01$) between perceived discrimination ($M = 3.72, SD = 1.11$) and perceived privilege ($M = 4.55, SD = 1.22$). Besides, perceived discrimination ($M = 3.72, SD = 1.11$) was strongly, significantly and positively correlated with anger ($M = 5.14, SD = 1.19, r(50) = 0.6, p < .01$). A moderate, significant and positive correlation ($r(50) = .44, p < .01$) between perceived discrimination ($M = 3.72, SD = 1.11$) and the willingness to support gender equality policies ($M = 4.61, SD = 1.37$). In addition, perceived unfairness ($M = 2.06, SD = 0.86$) was moderately, significantly and positively correlated with perceived privilege ($M = 4.55, SD = 1.22, r(50) = .35, p < .01$), anger ($M = 5.14, SD = 1.19, r(50) = .34, p < .05$) and the willingness to support gender equality policies ($M = 4.61,$

$SD= 1.37, r(50)= .37, p< .01$). Furthermore, there was a moderate, significant and positive correlation ($r(50)= .56, p< .01$) between perceived privilege ($M=4.55, SD=1.22$) and anger ($M= 5.14, SD= 1.19$) while the willingness to support gender equality policies ($M= 4.61, SD= 1.37$) was weakly, significantly and positively correlated ($r(50)= 0.30, p< .01$) with perceived privilege ($M= 4.55, SD= 1.22$). What is more, there was a moderate, significant and positive correlation ($r(50)= 0.50, p< .01$) between anger ($M= 5.14, SD= 1.19$) and the willingness to support policies of gender equality ($M= 4.61, SD= 1.37$). Those findings demonstrated that more perceived discrimination and unfairness towards female scientists predicted more perceived privilege of men over women, more anger and willingness to act to support gender equality policies.

Combining the analysis above, it can be seen that in both male and female group, the correlations between perceived discrimination against females scientists, perceived unfairness towards female scientists, perceived privilege of men over women, intergroup anger and the willingness to support gender equality policies were positive and significant. Furthermore, the strengths of those correlations were stronger in women group than that in men group. Therefore, the findings were consistent with what was expected in Hypothesis 1.

The effects of gender discrimination condition and gender on self-efficacy and interest in science

Two 2 (Gender: Women vs Men) x 3 (Gender Discrimination Conditions: High Discrimination vs Mitigated Discrimination vs Control) analysis of variance (ANOVA) were conducted to test the effect of gender and gender discrimination conditions on the self-efficacy and interest in science. These ANOVA analyses were intended to test *Hypothesis 2a*: exposure to three levels of gender discrimination of female scientists would affect women's and men's science interest and self-efficacy. Table 3 presents the mean and standard

deviation of the mean score of self-efficacy and interest of men and women in all three conditions.

Table 3

Means and standard deviations for scores of self-efficacy and science interest of men and women in three conditions

Variable	Gender	High Discrimination		Mitigated Discrimination		Control	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Self-efficacy	Male	5.03	0.93	5.13	0.82	4.90	1.13
	Female	5.06	1.00	4.63	1.06	5.08	0.78
Science Interest	Male	5.70	0.56	5.68	0.85	5.34	0.94
	Female	5.46	0.91	5.70	0.56	5.44	0.77

Science self-efficacy

The main effect of gender on the self-efficacy in science was not statistically significant ($F(1,143) = 0.31, p > .05, \eta^2 = .002$). Besides, there was no statistically significant main effect of three conditions on self-efficacy ($F(2, 142) = 0.34, p > .05, \eta^2 = 0.005$). In addition, the interaction effect between gender and three conditions was not statistically significant ($F(5, 139) = 1.68, p > .05, \eta^2 = .02$). The Bonferroni post-hoc tests indicated that there was no difference between males and females in three conditions. Therefore, gender and three conditions of gender discrimination had no effect on science self-efficacy.

Science Interest

Similarly, there was no significant main effect of gender on interest in science ($F(1,143) = 0.65, p > .05, \eta^2 = .01$). The main effect of gender discrimination condition on science interest was not statically significant ($F(2, 142) = .69, p > .05, \eta^2 = .01$). There was no significant interaction effect between gender and three conditions ($F(5, 139) = .51, p > .05, \eta^2 = .01$). The Bonferroni post-hoc tests showed that there was no difference on interest in

science in all three conditions between males and females. Therefore, no effects of gender and three levels of gender discrimination was found.

Combing the analysis above, under three levels of gender discrimination condition, men's and women's self-efficacy and interest in science had no significant differences. Therefore, hypothesis 2a was rejected.

The effects of conditions and gender on gender equality support

A 2(Gender: Women vs Men) x 3(Gender Discrimination Conditions: High Discrimination vs Mitigated Discrimination vs Control) analysis of variance (ANOVA) was conducted to test the effect of gender and gender discrimination conditions on the support for gender equality policies in both men and women. They were conducted to test *Hypothesis 2b*: exposure to three levels of gender discrimination of female scientists would affect men's and women's willingness to support gender equality. Table 4 shows the mean and standard deviation of the mean score of the willingness to support gender equality of men and women in all three conditions.

Table 4

Means and standard deviations for scores of the willingness to support gender equality policies of men and women in three conditions

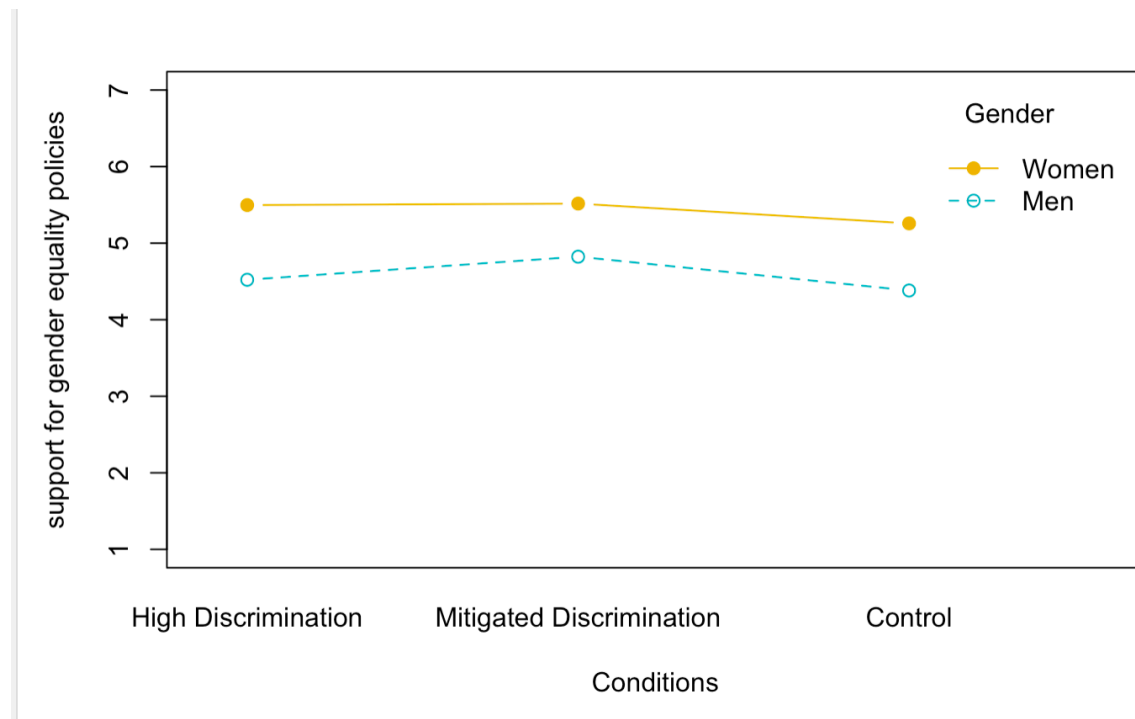
Gender	High Discrimination		Mitigated Discrimination		Control	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Male	4.52	1.50	4.82	1.30	4.38	1.38
Female	5.50	1.27	5.52	0.97	5.26	1.41

There was a significant main effect of gender on the willingness to support gender equality policies ($F(1, 143) = 14.09, p < .001, \eta^2 = .092$), which showed women were more likely to support gender equality policies than their male counterparts. The analysis of the

main effect for three gender discrimination conditions indicated that the main effect was not statistically significant ($F(2, 142) = 0.859, p > .05, \eta^2 = .012$). The interaction effect between gender and gender discrimination groups was also not statistically significant ($F(5, 140) = 0.138, p < .001, \eta^2 = .002$). The Bonferroni post-hoc tests indicated that in the high discrimination and control group, women's willingness to support gender equality policies was significantly higher than men's willingness (See Figure 1). Meanwhile, The Bonferroni post-tests indicated there was no difference between three conditions for males and females, which revealed that the manipulation of gender discrimination had no effect on the willingness to support gender equality policies. Hence, hypothesis 2a was rejected.

Figure 1

Mean plot of the score of the willingness to support gender equality policies of women and men in three conditions



The effects of conditions and gender on stereotypes of men competence, stereotypes of women competence and gender identification

Three 2 (Gender: Women vs Men) x 3(Gender Discrimination Conditions: High Discrimination vs Mitigated Discrimination vs Control) analysis of variance (ANOVA) was conducted to test the effect on men competence, women competence and gender identification. These ANOVA analysis were run to examine 1) *hypothesis 2c*: exposure to three levels of gender discrimination of female scientists would affect men's and women's stereotypes of competence associated with men and women; 2) whether gender identification changed in three conditions. The means and standard deviations of the scores of the stereotypes of men competence and women competence, and gender identification were displayed in Table 5.

Table 5

Means and standard deviations for scores of the stereotypes of men competence and women competence and gender identification of men and women in three conditions

Variable	Gender	High Discrimination		Mitigated compensation		Control	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Stereotypes of men competence	Male	4.31	0.67	4.02	0.77	4.10	0.91
	Female	3.79	0.90	3.59	0.83	4.36	0.82
Stereotypes of women competence	Male	5.19	1.51	4.61	1.91	5.04	1.68
	Female	4.99	2.06	5.13	1.68	4.84	1.49
Gender identification	Male	3.29	0.83	3.18	1.01	3.50	1.37
	Female	3.63	0.93	3.80	1.13	3.88	1.24

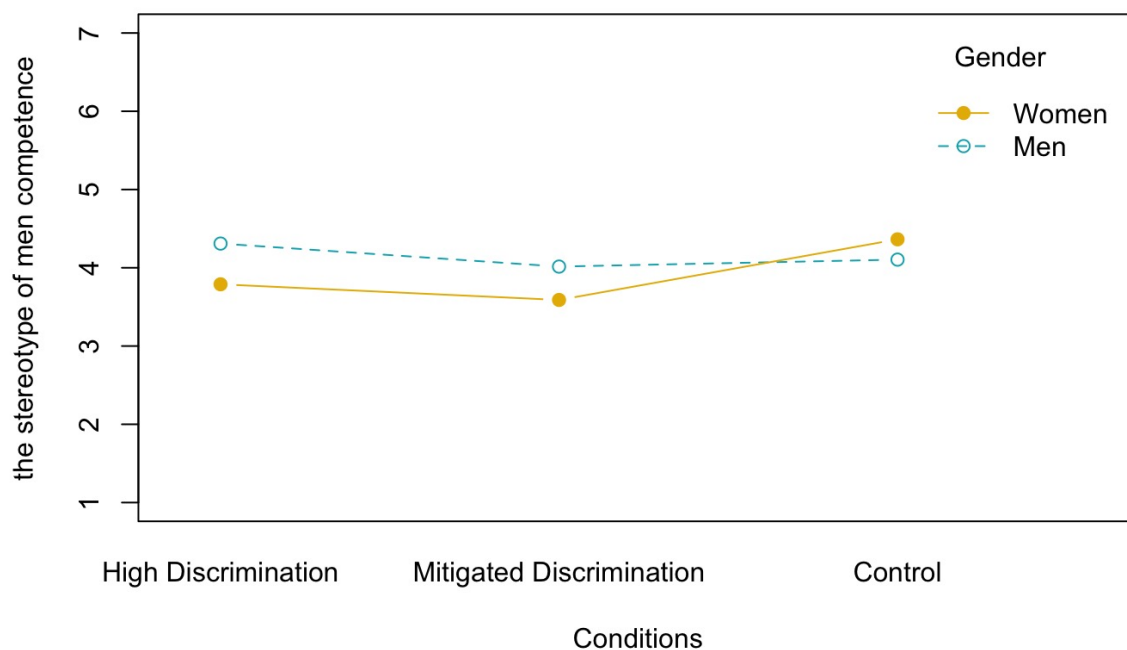
The stereotype of men competence

The main effect of gender on the men competence was not statistically significant ($F(1, 143) = 2.49, p > .05, \eta^2 = .018$). However, there was statistically significant main effect of gender discrimination condition on men competence science ($F(2, 142) = 3.21, p < .05, \eta^2 = .044$). This demonstrated that in the mitigated discrimination condition, men and women had the lowest stereotype of men competence while the stereotype was highest in higher

discrimination condition. The interaction effect between gender and three conditions was also not significant ($F(5, 139) = 2.82, p > .05, \eta^2 = .039$). The Bonferroni post-hoc test indicated that women had a lower stereotype of men competence in high discrimination group or in mitigated discrimination group than in control condition (See Figure 2). However, the test revealed no significance difference on the stereotypes of men competence between high discrimination and mitigated discrimination. As for men, there was no difference on the stereotype of men competence between three conditions.

Figure 2

Mean plot of the score of the stereotypes of men competence of men and women in three conditions



The stereotypes of women competence

The main effect of gender on the importance of women competence was not statistically significant ($F(1, 143) = .02, p > .05, \eta^2 = .00$). In addition, no statistically significant main effect of three conditions on the importance of women competence was

found($F(2, 142) = .18, p > .05, \eta^2 = .003$). Furthermore, the interaction effect between gender and three conditions was not statistically significant($F(5, 139) = .68, p > .05, \eta^2 = .01$). The Bonferroni post-hoc tests indicated that there was no difference on the importance of women competence between men and women in three conditions. In other words, gender and gender discrimination conditions had no effect on the importance of women competence.

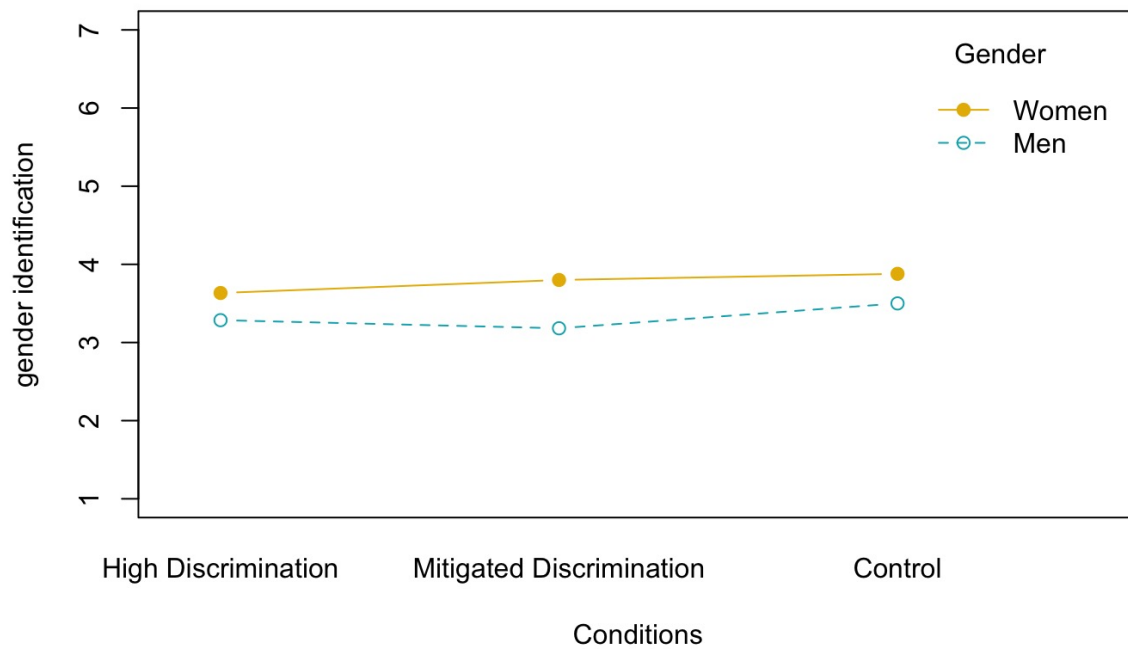
In response to Hypothesis 2c, no gender effects on stereotypes of men and women competence was found. However, different levels of gender discrimination had effects on stereotypes of men competence but not on women competence.

Gender identification

The main effect of gender on gender identification was statistically significant ($F(1,143) = 5.37, p < .05, \eta^2 = .37$). This indicated that women were more identified with their gender than their male counterparts. However, there was no significant main effect of gender discrimination condition($F(2, 142) = .54, p > .05, \eta^2 = .008$). The interaction effect between gender and three conditions was not statistically significant($F(5, 139) = 21, p > .05, \eta^2 = .003$). The Bonferroni post-hoc tests showed that in the compensation condition, women identified more with their gender than men but in another two conditions, there was no difference between women and men (See Figure 3). Therefore, although there was gender differences, no significant effect of gender discrimination conditions indicated that the gender identification was controlled across different conditions.

Figure 3

Mean plot of the score of gender discrimination of men and women in three conditions



Discussion

Although many efforts have been made to address gender discrimination, it still persists in different forms in scientific fields and leads to a further dearth of women in science. The primary aim of this study was to examine the effect of information of gender discrimination on women and men in terms of their interest and self-efficacy in science. The second aim was to investigate how the information of gender discrimination affect men's and women's perceived privilege of men over women, anger and the willingness to act to support gender equality. To do so, adult men and women participants were randomly assigned to one of three conditions with different gender discrimination information: a) high discrimination b) mitigated discrimination c) control condition.

The relationships between appraisals of intergroup relations, anger and gender equality support

As hypothesized, the more women (the disadvantaged group) perceived discrimination and unfairness against female scientists, the more they perceived privilege of

men over women, the more they experienced anger and wanted to support gender equality. This result was consistent with previous research that the disadvantaged group were more likely to perceive injustice and disadvantage, thus experiencing anger and having behavioral tendencies (Bettencourt et al., 2001; Ellemers et al., 1993; Mummendey et al., 1999; Walker & Smith, 2002; Wright, 2001). Similarly, as predicted, males (the advantaged group) had the same pattern. This was congruent with previous studies which indicated that those with privilege may perceive the inequality as unfair and experience anger and thus are motivated to mitigate the inequality. (Iyer & Leach, 2010; Leach et al., 2006; Tiedens & Leach, 2004; Leach et al., 2002; van Zomeren et al., 2008).

However, although appraisals of intergroup relations were found to be positively correlated with anger and support, the strengths of correlations varied. For example, for both females and males, perceived discrimination was mediately correlated with anger and the willingness to support while there was a weak correlation between perceived unfairness and anger and the willingness to act to support gender equality. This indicated that perceived discrimination compared to perceived unfairness, was more likely to elicit anger and behavioral tendency to support gender equality, which may have implications on how to promote gender equality by exposing the public to gender discrimination information. Besides, it was also interesting to note that although men's perceived discrimination strongly predicted intergroup anger, there was only a weak correlation between anger and the willingness support. This might be partly explained by the intentions of the advantaged group to maintain their group members' interest (Ellemers et al., 2002).

The effect of gender discrimination information and gender on interest and self-efficacy in science

The finding of no effect of gender on interest was not consistent with previous research that indicated men and women had differential interest in science, with men more

interested in science(Su & Rounds, 2015). The conflicting results may be because this research did not take into consideration different characteristics of diverse scientific fields. Previous research found that in the domain of science, women showed interest in some scientific areas such as psychology while they demonstrated less interest in other fields, such as engineering(Ceci et al., 2009; Su & Rounds, 2015). This was also in alignment with underrepresentation in some scientific areas and growing number of females in others. More clearly, according to Su and his colleagues(2009), men preferred to work with things (i.e., natural science) while their female counterparts were willing to work with people (i.e., social science). This was consistent with the findings that girls showed the interest in life science instead of physical science due to their desire to care for animals or people (Blickenstaff, 2005). Therefore, without specifying which specific field of science in this research, women were likely to report interest as much as men, hence showing no gender difference. In response to the first research question, the findings indicated that when it comes to the domain of science as a whole, women had the same level of interest and self-efficacy in science as men.

The result also indicated that the information of gender discrimination had no effect on men's and women's interest and self-efficacy in science. No gender discrimination effect on women was contradicted by career development model proposed by Astin (1984) that individuals who perceive discrimination in workplace may reduce their interest and aspirations due to potential less opportunities. However, in this study, over 60% female participants reported their work involved science, which may barely affect their interest and self-efficacy due to past performance and experience(Bandura, 1977). Moreover, empirical research has examined how gender discrimination knowledge affected girls and the result was consistent with this study, indicating the interest in science is difficult to alter with experiment manipulation in a short time (Mason & Kahle, 1989; Weisgram & Bigler, 2006).

In addition, in a study focusing on girl students' self efficacy, the result showed that girl had increased self-efficacy due to the knowledge of discrimination, which may be explained by their reinterpretation of their past negative feedback(Weisgram & Bigler, 2007). Therefore, considering female participants in this research represented a broad range of vocations and age as opposed to girl school students and thus there was more variability in attitudes towards self-efficacy(Iyer & Ryan, 2009), it was likely to show no effects of gender discrimination. What is also worth noting is that this research found there was also no effects of different levels of gender discrimination on stereotypes of women. This is in line with existing research which indicated that the stereotype that women lack competence compared to men has effects on women's interest and self-efficacy(Denissen et al., 2007; March et al., 2005).

As for men, little empirical research has examined the effect on male groups who benefited from gender discrimination. Based on existing literature, no effect of the information of gender discrimination on males may be due to two opposite effects. On one hand, the ingroup privilege may elicit negative emotions such as guilt and anger, which reduced men's interest (Branscobe,1998). On the other hand, men may attribute their success to their competence, which may boost their interest and self-efficacy (Leach et al., 2007). This was also supported by the result of stereotypes of men competence that in high discrimination and mitigated discrimination condition, men had a higher stereotype of men competence than women.

The effect of gender discrimination information and gender on gender equality support

As predicted, females as disadvantaged group showed more willingness to take action to support gender equality than their male counterparts. Little previous research directly experimented on both the advantage group and the disadvantaged group. Nevertheless, the result was in line with social identity theory that the disadvantaged were more likely to

engage in action aimed at equality because their interests were hurt (Guimond & Dubé-Simard, 1983; Tajfel & Turner, 1979).

However, the knowledge of gender discrimination showed no effect on the willingness to support, which was not congruent with previous studies indicating that the perception of group unfairness was key to collective action (Ellemers, 2002; Smith & Ortiz, 2002; Tyler et al., 1997; Wright & Tropp, 2002). Several reasons may account for this inconsistency. Firstly, according to the model proposed by van Zomeren and his colleagues (2004), two distinct pathways contribute to collective action: intergroup anger and group efficacy. In other words, collective action would be higher when individuals experience anger and also know others share the same opinion and stand united (van Zomeren et al., 2004). However, in this study, only the anger was measured without information about how others perceive; therefore, there was no significant difference caused by the information of gender discrimination (van Zomeren et al., 2004). Besides, this research also found that participants considered men competence were more important under high discrimination condition. This was consistent with traditional gender stereotypes that men are more competent in science than women (Denissen et al., 2007; March et al., 2005). In that case, instead of perceiving gender discrimination, participants may justify gender inequality with stereotypes and thus showed little willingness to support gender equality (Glick & Fiske, 2001). In addition, Iyer and Ryan (2009) also suggested that justice and fairness may not be salient in deciding whether to take actions to support inequality. It was also important to include self-relevance which means the degree of how widespread the inequality is perceived to be (Iyer & Ryan, 2009). In other words, if individuals think that the gender discrimination is not pervasive enough, they will show a lower willingness to take action to support gender equality even if they experience anger. Therefore, despite the findings of no gender discrimination effect on the willingness to support, it indicated more future research to investigate further.

Limitations and future directions

Despite the well-designed study, there were some possible limitations.

The first one is that the domain of science may be too broad to detect gender differences. In some scientific fields such as biological and health sciences, there was a high women-men ratios, even higher than 1:1 while in areas such as physics and engineering, women represent a much less proportion(Kahn & Ginther, 2015). Meantime, in fields where there are more females, it is less likely to experience gender discrimination. Therefore, including social science or other scientific fields that many women engage in will eclipse the existence of gender discrimination of other scientific areas and lead to no significant result. Future work focusing on how to improve gender discrimination in science should address this by examining more specific science fields.

In addition, there were several limitations of the experiment design. Firstly, since the experiment was in the form of self-reporting questionnaire, there may be credibility problems. When people do the survey, they tend to report less negative feelings or opinions due to self-enhancement or self-presentation, thus leading to a biased self-report(Robins et al., 2007). In this research, self-report may not accurately reflect people's perceived discrimination and unfairness against female scientists and perceived privilege of men over women, even though the survey was online and anonymous and the evidence in the scenario was clear(Reilly et al., 2017). Future researchers should adopt verbal and non-verbal measures. Secondly, the study was a between-subjects design. Because of this, the researcher cannot assess whether each individual has different attitudes towards science, emotions and behavioral tendencies to promote gender equality due to different levels of gender discrimination. Future research is expected to address this issue by adopting a mixed design. Thirdly, the researchers only examined immediate perceptions and reactions to different gender discrimination conditions. However, it is likely that the effect may strengthen or

weaken over time (Weisgram & Bigler; 2007). Therefore, future studies should investigate long-term effects of how different levels of gender discrimination affect people's self-efficacy and interest in science as well as the willingness to support gender equality.

Fourthly, the manipulation of gender discrimination in the form of text may not be strong enough to be perceived. Existing research has indicated that compared to reading print, participants reported more anger and willingness to act when watching video (Glasford, 2013). Future research should adopt a more appropriate and powerful way to manipulate.

Finally, although the research included gender identification, the sample size (Female=93, Male=45) was not large enough in this research to show its effect on other variables. However, existing research has indicated that it could moderate the effect of how people perceived discrimination and experienced emotions, with high identified individuals and low identified individuals reporting different results (Iyan & Ryan, 2009). Therefore, future research is expected to collect more data and examine how gender identification affect the way women and men react to gender discrimination in terms of interest and self-efficacy in science and experienced anger as well as the willingness to support gender equality policies.

Potential implications

Theoretically, this study added more information to structural equation model (van Zomeren et al., 2004) by directly comparing men's (the advantaged group) and women's (the disadvantaged group) experienced anger and the willingness of actions to promote equality and broadened the model with gender context.

In the meantime, there are also some practical applications. The research aimed to examine whether the information of gender discrimination would affect men and women in terms of interest and self-efficacy in science and propose suggestions to improve the gender inequality situation. The results indicated several factors pertaining to people's attitudes

towards science and the willingness to support gender equality, which provided empirical evidence to promote gender equality. Specifically, the presentation of gender discrimination of specific female figures could elicit women's and men's anger and willingness to support gender equality, which verifies the need to more exposure to knowledge of gender discrimination in scientific fields in different kinds of media. Besides, the effect of different levels of gender discrimination on stereotypes of men competence indicated that the society should pay heed to how to portray gender roles of scientists especially in TV and film industry which has a cultural and social weight yet helps perpetuate gender stereotype and inequality currently (UNESCO, 2019; Xu et al., 2019).

Conclusion

Little previous research has investigated the effect of different levels of gender discrimination in scientific field on adult women's and men's interest and self-efficacy in science as well as the willingness to support gender equality policies. This research aimed to offer more sights to how to better present the information of gender discrimination in science to boost women's and men's interest and self-efficacy in science and promote gender equality. As expected, more perceived discrimination and unfairness towards female scientists predicted more perceived privilege of men over women, more experienced anger and willingness to support gender equality. This provided empirical evidence on how to promote gender equality more effectively. Besides, the effect of different levels of gender discrimination on stereotype of men competence indicated that the way gender discrimination was presented can have an influence on gender stereotypes, which may lead to a vicious circle and should not be ignored especially when media is pervasive in this age. Although no significant effect of different levels of gender discrimination on women's and men's interest and self-efficacy in science and the willingness to support gender equality was found, the explanations of possible reasons for the result facilitated understanding on how women's and

men's interest and self-efficacy in science and action tendency towards gender equality is affected. Meantime, future study can continue to explore the effects of different levels of gender discrimination in scientific fields based on reflections on limitations of this research.

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Appendices

Appendix A: Ethics Approval Letter

3rd June 2020

Dear Yan,

School of Education Research Ethics Committee

Project Title: How can knowledge about female scientists affect gender equality support, confidence and interest in science in both women and men?

Application No: 402190263

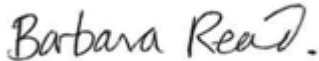
The School of Education Research Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project, subject to the following conditions:

- Start date of ethical approval: 03/06/20
- Project end date: 15/08/21
- Any outstanding permissions needed from third parties in order to recruit research participants or to access facilities or venues for research purposes must be obtained in writing and submitted to the School of Education Research Ethics Administrator before research commences. Permissions you must provide are shown in the reviewer feedback form, titled *Notification of Ethics Application Outcome*, that has been sent to you.
- Data collected should be held securely for the period you indicated in the application and any personal data collected should be appropriately managed in accordance with the General Data Protection Regulation.
- The research should be carried out only on the sites, and/or with the groups and using the methods defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment as an amendment to the original application. The *Request for Amendments to an Approved*

Application form should be used:

<https://www.gla.ac.uk/schools/education/research/ethics/forms/>

Yours sincerely,

A handwritten signature in black ink that reads "Barbara Read." The signature is enclosed in a thin black rectangular box.

Dr Barbara Read

School of Education Ethics Officer

Appendix B: Plain Language Statement

Title of project and researcher details

Title of Project: Male and Female scientists' lives and rewards

Researcher: Yan Ma

Supervisor: Dr Leyla De Amicis

Programme: MSc Psychological Studies (conversion)

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the study?

This study intends to explore whether knowing some information on scientists and scientific achievements and awards can affect public interest and confidence in science. This investigation will consist of an online survey that will be distributed to adult people with an intermediate/good level of English language. The completion of the online survey will take around 20 minutes. During this research you will be presented with some information about male and female scientists. At the end of this online survey you will be given more details about this dissertation project.

Why have I been chosen?

You have been contacted to take part because you are an adult person with a good level of English spoken/written. Your opinions can help improving the situation of interest in science.

Do I have to take part?

No, all participation is voluntary meaning that you will only take part if you wish to do so. You have a right to withdraw from the study at any time during the survey and even if consent has been given. The researchers understand that some information might be for some people distressing especially under the current circumstances if a pandemic and lockdown period so guidelines of where to get help and advice should you need it will be provided (i.e. Everyman Project, British Association of Anger Management, Women's Aid). The researcher appreciates the time and contributions of all participants.

What will happen to me if I take part?

If you would like to take part in this study, you will be asked to fill in an online consent form and then you will take part in an online survey which should last no longer than 20 minutes.

Will my taking part in this study be kept confidential?

We want to ensure your personal information or any personal identifying information about yourself or your family is kept confidential. The online survey will not collect identifiable data to protect your information. Any survey data will be stored in a secure location and on a password protected computer and will only be available to the researcher and her supervisor with all personal information and anonymity protected.

What will happen to the results of the research study?

The results of this study will be written into a research report for the researchers Master of Science, Psychological Studies Dissertation. The Dissertation will be written by the 14th August 2020 and only anonymised data will be present in the report. The research data will be possibly utilised for publication and presentations to conferences, analysed together with other research material. You will not be able to be identified in the report and in future publications/presentations. Please contact the researcher by email if you would like to obtain a copy after the research project has been submitted.

Who has reviewed the study?


This research project has been reviewed by the University of Glasgow School of Education Ethics Forum.

Contact for Further Information

If you have any questions about this study, you can ask me, (2437195M@student.gla.ac.uk) or my supervisor, Dr Leyla De Amicis (leyla.deamicis@glasgow.ac.uk).

If you have any concerns regarding the conduct of this research project, you can contact the School of Education Ethics Officer, Dr Barbara Read, at Barbara.read@glasgow.ac.uk.

Appendix C: Recruitment Poster



University of Glasgow

Male and Female Scientists' Lives and Rewards

Your opinions matter !

This project intends to explore whether knowing some information on scientists and scientific achievements and awards can affect public interest and confidence in science and your opinions can help improving the situation of interest in science.

The project has been approved by the School of Education Ethics Committee at the University of Glasgow and all information will be kept confidential.

Eligibility

- adults (more than 18 years old)
- a good level of English (spoken/written)

More information

The survey will take **around 20 minutes via the link** https://businessschoolab.eu.qualtrics.com/jfe/form/SV_2f9VTzaWXYrgVHD and you will be given more details about the project at the end.

If you have any questions, please email the researcher (Yan) at 2437195m@student.gla.ac.uk or the supervisor (Leyla) at Leyla.deamicis@Glasgow.ac.uk

Appendix D: Consent Form

Research topic: Male and female scientists' lives and rewards

Researcher: Ms Yan MA

Supervisor: Dr Leyla De Amicis

Programme: MSc Psychological Studies (conversion)

I confirm that I have read and understood the Participant Information Sheet for the above study and have had the opportunity to ask questions.

I understand that my participation is voluntary.

I understand that I will be presented with some information, and provided with more details about the dissertation project, when I complete the online survey.

I understand that I am free to withdraw at any time while answering the survey, without giving any reason.

The research data will be treated as confidential and kept in secure storage at all times.

The research data will be retained in secure storage for use in future academic research.

I agree to waive my copyright to any data collected as part of this project so that my unidentifiable data can be published or presented to conferences, analysed together with all other material.

I agree to take part in this research study.

Name of Participant

Signature Date

Name of Researcher

Signature Date
.....

..... **End of consent form**

Appendix E: Survey of high discrimination condition

Did you know that? You might like science or not, you might know a lot about it or just a little, but you might have never heard about the behind the scenes of these extraordinary discoveries...Please read the following information carefully, and after, we will ask you with some questions. Remember that we are interested in your opinions, there are no wrong or right questions on this. Thanks in advance for your collaboration.

Before reading this information, please provide the following information:

Age:

Gender

- Male
- Female
- not binary
- prefer not to say

Education

- High school graduate, diploma or the equivalent
- Bachelor's degree
- Master's degree
- Doctorate degree
- other, specify _____

Occupation

How much science did you use in your studies?

- Not at all
- Little
- Some
- A lot

How much science is involved in your occupation (current or aspired one, if you are unemployed)

- Not at all
- Little
- Some
- A lot

How much science was involved in your past occupations?

- Not at all
- Little
- Some
- A lot
- I have not worked before

Political views

- Far Left
- Left
- Centre
- Right
- Far Right

Ethnicity

- White (specify) _____
- Black (specify) _____
- Mixed (specify) _____
- Asian (specify) _____
- Arab (specify) _____
- Prefer not to say

Origin country

- Scotland
- UK- out of Scotland
- European countries (outside the UK) (specify)

- Outside European countries (specify)

Country of residence

- Scotland
- UK-out of Scotland
- European countries - outside the UK (specify)

- Outside European countries (specify)

Here are some stories about female scientists, their contribution to science, their colleagues and their scientific awards. Please read this information carefully:

1. The Austrian physicist Lise Meitner (1878-1968, Vienna) discovered with her colleagues, the scientists Otto Hahn and Otto Robert Frisch, the nuclear fission of uranium, which is the basis of the development of nuclear weapons and electricity production. Although Meitner strictly collaborated and contributed to this extraordinary discovery, in 1944 the Nobel Peace Prize in Chemistry was given exclusively to her fellow scientist Hahn, who was credited for having discovered nuclear fission.

2. Rosalind Franklin (1920-1957, London) was a chemist, X-ray crystallographer and leading molecular biologist who discovered the structure of DNA. As a Research Associate at King's College she captured an image of the DNA's molecular structure, the famous Photo 51. Maurice Wilkins, Franklin's colleague, without Franklin's permission, used Photo 51 with his colleagues Francis Crick and James Watson to publish on the DNA and won the Nobel Peace Prize for this in 1962. Franklin died in 1958 and her contribution to this discovery was toned down. Her exclusion from the Nobel Prize was later justified by saying this award is not assigned posthumously.

3. Jocelyn Bell Burnell (born in 1943, Lurgan, Northern Ireland) is an astrophysicist who in 1967, when she was a postgraduate student working on her experiments monitoring quasars, discovered the pulsars, a series of regular radio pulses which are the remains of massive stars that went supernova. This discovery was considered one of the most significant scientific achievements of the 20th century and it was recognised by the award of the 1974 Nobel Prize in Physics. However, this prize was not given to Bell Burnell but to Anthony Hewish, Bell Burnell's supervisor, and another colleague, Martin Ryle.

Test your memory/learning

What did Rosalind Franklin discover? (If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Rosalind Franklin win a Nobel Prize?

- Yes
- No
- I don't know

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Rosalind Franklin has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

What did Lise Meitner discover?(If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Lise Meitner win a Nobel Prize?

- Yes
- No
- I don't know.

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Lise Meitner has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

What did Jocelyn Bell Burnell discover?(If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Jocelyn Bell Burnell win a Nobel Prize?

- Yes
- No
- I do not know

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Jocelyn Bell Burnell has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

28. Working
in a science
laboratory
would be
an
interesting
way to
learn a
living

29. A job as
a scientist
would be
interesting

30. A
career in
science
would be
dull and
boring

How willing would you be to...?	Very unwilling	Quite unwilling	A little unwilling	Neither unwilling nor willing	A little willing	Quite willing	Very willing
1. "send a letter to the government to ask for more gender equality in schools and working places"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. "sign a letter written by academics to be published on popular newspapers which condemns the denial of women's achievements in science and arts"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. "help organize a demonstration for gender equality in the country"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. "sign a petition to ask for equal number of admissions/career development for women and men in academia"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. "sign a petition to ask for equal number of promotions for women and men in academia"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. "sign a petition to ask for equal number of men and women in scientific committees".	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. "donate money to the cause of gender equality in higher education"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. "ask institutions to increase numbers of bursaries for girls/female adolescents in science"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. "support policies for women's study leave to improve their education/qualifications in science".

10. "support national and international events to promote science among girls/women".

Please answer the following questions

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
1. It is important for me to be a woman/man.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Being a man/woman has nothing to do with my identity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I feel strong ties with men	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I feel strong ties with women	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I am very critical of men.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I am very critical of women.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How important do you think it is for Men and Women to be...?

For men:

	Very unimportant	Unimportant	Moderately important	Important	Very important
"honest"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"sincere"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"trustworthy"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"likeable"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"warm"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"friendly"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"competent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"intelligent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"skilled"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For Women:

	Very unimportant	Unimportant	Moderately important	Important	Very Important
"honest"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"sincere"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"trustworthy"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"likeable"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"warm"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"friendly"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"competent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"intelligent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"skilled"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you very much for your time and opinions! If you prefer to withdraw from this study, remember you can still do it by closing the tab, otherwise click 'Submit'.

Submit

Debriefing:

Thank you for your time! We understand that some information might be distressing especially under the current circumstances of a pandemic and lockdown period. Therefore, if you feel upset, you can get help and advice from organizations such as Samaritans, Everyman Project, British Association of Anger Management and Women's Aid.

Here, we would like to tell you more about this study. This study intends to explore how exposure to information about unfavourable treatment faced by female scientists can affect men's and women's self-efficacy and interest in science. The stories you have read are true but they have been presented differently to different people randomly. This is to see how the presentation of information about denial of rewards or/and late rewards can affect how men and women perceive unfavourable treatment which affects female scientists. Please do not share this information with whoever is going to take this online survey as this will invalidate this research. We hope you can see the value of this work as much as we can see it.

This survey is for the MSc dissertation. If you have any further questions about this study, you can ask me, (2437195M@student.gla.ac.uk) or my supervisor, Dr Leyla De Amicis (leyla.deamicis@glasgow.ac.uk).

Information for more help:

Samaritans (UK):

tel: 116 123

Everyman Project:

website: <http://www.everymanproject.co.uk/>

tel: +44 0203 642 8850

British Association of Anger Management:

website: <https://www.angermanage.co.uk/>

tel: +44 0345 1300 286

Women's Aid:

website: <https://www.womensaid.org.uk/>

email: helpline@womensaid.org.uk

Appendix F: Survey of mitigated discrimination condition

Did you know that? You might like science or not, you might know a lot about it or just a little, but you might have never heard about the behind the scenes of these extraordinary discoveries...Please read the following information carefully, and after, we will ask you with some questions. Remember that we are interested in your opinions, there are no wrong or right questions on this. Thanks in advance for your collaboration.

Before reading this information, please provide the following information:

Age:

Gender

- Male
- Female
- not binary
- prefer not to say

Education

- High school graduate, diploma or the equivalent
- Bachelor's degree
- Master's degree
- Doctorate degree
- other, specify _____

Occupation

How much science did you use in your studies?

- Not at all
- Little
- Some
- A lot

How much science is involved in your occupation (current or aspired one, if you are unemployed)

- Not at all
- Little
- Some
- A lot

How much science was involved in your past occupations?

- Not at all
- Little
- Some
- A lot
- I have not worked before

Political views

- Far Left
- Left
- Centre
- Right
- Far Right

Ethnicity

- White (specify) _____
- Black (specify) _____
- Mixed (specify) _____
- Asian (specify) _____
- Arab (specify) _____
- Prefer not to say

Origin country

- Scotland
- UK- out of Scotland
- European countries (outside the UK) (specify)

- Outside European countries (specify)

Country of residence

- Scotland
- UK-out of Scotland
- European countries - outside the UK (specify)

- Outside European countries (specify)

Here are some stories about female scientists, their contribution to science, their colleagues and their scientific awards. Please read this information carefully:

1. The Austrian physicist Lise Meitner (1878-1968, Vienna) discovered with her colleagues, the scientists Otto Hahn and Otto Robert Frisch, the nuclear fission of uranium, which is the basis of the development of nuclear weapons and electricity production. Although she was not given a Nobel Prize for this discovery, which went exclusively to her fellow scientist Hahn, Meitner was the first woman to be assigned a professorial title in Germany and had many awards later in her career.

2. Rosalind Franklin (1920-1957, London) was a chemist, X-ray crystallographer and leading molecular biologist who discovered the structure of DNA. As a Research Associate at King's College she captured an image of the DNA's molecular structure, the famous Photo 51. Although Rosalind Franklin's discoveries led to two Nobel Prizes which were given to her colleagues but not to her, her publication with Gosling in Nature (1953) was the most important evidence of the DNA's structure. Recently, several awards have been established in Rosalind Franklin's name and the ExoMars rover was also named after her by the European Space Agency (ESA) in 2019.

3. Jocelyn Bell Burnell (born in 1943, Lurgan, Northern Ireland) is an astrophysicist who in 1967, when she was a postgraduate student working on her experiments monitoring quasars, discovered the pulsars, a series of regular radio pulses which are the remains of massive stars that went supernova. Although this discovery led to the award of the 1974 Nobel Prize in Physics, which was given to Anthony Hewish, Bell Burnell's supervisor, and another colleague, Martin Ryle, in 1999 Jocelyn Bell Burnell was appointed Commander of the Order of the British Empire (CBE) for services to Astronomy.

Test your memory/learning

What did Rosalind Franklin discover? (If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Rosalind Franklin win a Nobel Prize?

- Yes
- No
- I don't know

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Rosalind Franklin has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

What did Lise Meitner discover?(If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Lise Meitner win a Nobel Prize?

- Yes
- No
- I don't know.

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Lise Meitner has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

What did Jocelyn Bell Burnell discover?(If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Jocelyn Bell Burnell win a Nobel Prize?

- Yes
- No
- I do not know

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Jocelyn Bell Burnell has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

28. Working
in a science
laboratory
would be
an
interesting
way to
learn a
living

29. A job as
a scientist
would be
interesting

30. A
career in
science
would be
dull and
boring

How willing would you be to...?	Very unwilling	Quite unwilling	A little unwilling	Neither unwilling nor willing	A little willing	Quite willing	Very willing
1. "send a letter to the government to ask for more gender equality in schools and working places"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. "sign a letter written by academics to be published on popular newspapers which condemns the denial of women's achievements in science and arts"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. "help organize a demonstration for gender equality in the country"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. "sign a petition to ask for equal number of admissions/career development for women and men in academia"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. "sign a petition to ask for equal number of promotions for women and men in academia"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. "sign a petition to ask for equal number of men and women in scientific committees".	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. "donate money to the cause of gender equality in higher education"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. "ask institutions to increase numbers of bursaries for girls/female adolescents in science"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. “support policies for women’s study leave to improve their education/qualifications in science”.

10. “support national and international events to promote science among girls/women”.

Please answer the following questions

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
1. It is important for me to be a woman/man.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Being a man/woman has nothing to do with my identity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I feel strong ties with men	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I feel strong ties with women	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I am very critical of men.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I am very critical of women.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How important do you think it is for Men and Women to be...?

For men:

	Very unimportant	Unimportant	Moderately important	Important	Very important
"honest"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"sincere"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"trustworthy"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"likeable"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"warm"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"friendly"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"competent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"intelligent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"skilled"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For Women:

	Very unimportant	Unimportant	Moderately important	Important	Very Important
"honest"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"sincere"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"trustworthy"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"likeable"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"warm"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"friendly"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"competent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"intelligent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"skilled"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you very much for your time and opinions! If you prefer to withdraw from this study, remember you can still do it by closing the tab, otherwise click 'Submit'.

Submit

Debriefing:

Thank you for your time! We understand that some information might be distressing especially under the current circumstances of a pandemic and lockdown period. Therefore, if you feel upset, you can get help and advice from organizations such as Samaritans, Everyman Project, British Association of Anger Management and Women's Aid.

Here, we would like to tell you more about this study. This study intends to explore how exposure to information about unfavourable treatment faced by female scientists can affect men's and women's self-efficacy and interest in science. The stories you have read are true but they have been presented differently to different people randomly. This is to see how the presentation of information about denial of rewards or/and late rewards can affect how men and women perceive unfavourable treatment which affects female scientists. Please do not share this information with whoever is going to take this online survey as this will invalidate this research. We hope you can see the value of this work as much as we can see it.

This survey is for the MSc dissertation. If you have any further questions about this study, you can ask me, (2437195M@student.gla.ac.uk) or my supervisor, Dr Leyla De Amicis (leyla.deamicis@glasgow.ac.uk).

Information for more help:

Samaritans (UK):

tel: 116 123

Everyman Project:

website: <http://www.everymanproject.co.uk/>

tel: +44 0203 642 8850

British Association of Anger Management:

website: <https://www.angermanage.co.uk/>

tel: +44 0345 1300 286

Women's Aid:

website: <https://www.womensaid.org.uk/>

email: helpline@womensaid.org.uk

Appendix G: Survey of control condition

Did you know that? You might like science or not, you might know a lot about it or just a little, but you might have never heard about the behind the scenes of these extraordinary discoveries...Please read the following information carefully, and after, we will ask you with some questions. Remember that we are interested in your opinions, there are no wrong or right questions on this. Thanks in advance for your collaboration.

Before reading this information, please provide the following information:

Age:

Gender

- Male
- Female
- not binary
- prefer not to say

Education

- High school graduate, diploma or the equivalent
- Bachelor's degree
- Master's degree
- Doctorate degree
- other, specify _____

Occupation

How much science did you use in your studies?

- Not at all
- Little
- Some
- A lot

How much science is involved in your occupation (current or aspired one, if you are unemployed)

- Not at all
- Little
- Some
- A lot

How much science was involved in your past occupations?

- Not at all
- Little
- Some
- A lot
- I have not worked before

Political views

- Far Left
- Left
- Centre
- Right
- Far Right

Ethnicity

- White (specify) _____
- Black (specify) _____
- Mixed (specify) _____
- Asian (specify) _____
- Arab (specify) _____
- Prefer not to say

Origin country

- Scotland
- UK- out of Scotland
- European countries (outside the UK) (specify)

- Outside European countries (specify)

Country of residence

- Scotland
- UK-out of Scotland
- European countries - outside the UK (specify)

- Outside European countries (specify)

Here are some stories about female scientists, their contribution to science, their colleagues and their scientific awards. Please read this information carefully:

1. The Austrian physicist Lise Meitner (1878-1968, Vienna) discovered with her colleagues, the scientists Otto Hahn and Otto Robert Frisch, the nuclear fission of uranium, which is the basis of the development of nuclear weapons and electricity production. The discovery of the nuclear fission of uranium was important because it showed how the uranium nucleus can be split in two and if this fission reaction emits enough secondary neutrons, a chain reaction can occur and release an extraordinary amount of energy.

2. Rosalind Franklin (1920-1957, London) was a chemist, X-ray crystallographer and leading molecular biologist who discovered the structure of DNA. As a Research Associate at King's College she captured an image of the DNA's molecular structure, the famous Photo 51. Photo 51 is an X-ray diffraction image that gave some crucial pieces of information to realise that the DNA must have a double helical structure. It was the 51st photo taken on a strand of DNA extracted from human calf tissue, and it is used now by the Wellcome Trust in a project intended to describe the story of genetics, from Mendel to the Human Genome Project.

3. Jocelyn Bell Burnell (born in 1943, Lurgan, Northern Ireland) is an astrophysicist who in 1967, when she was a postgraduate student working on her experiments monitoring quasars, discovered the pulsars, a series of regular radio pulses which are the remains of massive stars that went supernova. The discovery of pulsars is very important because they are used to study extreme states of matter, look for planets beyond the Earth's solar system and assess cosmic distances. Pulsars also help scientists find gravitational waves, which could in turn help to identify/understand collisions between black holes.

Test your memory/learning

What did Rosalind Franklin discover? (If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Rosalind Franklin win a Nobel Prize?

- Yes
- No
- I don't know

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Rosalind Franklin has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

What did Lise Meitner discover?(If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Lise Meitner win a Nobel Prize?

- Yes
- No
- I don't know.

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Lise Meitner has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

What did Jocelyn Bell Burnell discover?(If you do not remember the answer, do not worry about it or you can skip this question!)

- DNA's structure
- Pulsars
- Nuclear fission

Did Jocelyn Bell Burnell win a Nobel Prize?

- Yes
- No
- I do not know

If she didn't, how much do you agree that this was because of gender discrimination?

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

How fairly do you think that Jocelyn Bell Burnell has been awarded for her scientific achievements?

- Completely unfairly
- Somewhat unfairly
- neither unfairly nor fairly
- Somewhat fairly
- Completely fairly

28. Working
in a science
laboratory
would be
an
interesting
way to
learn a
living

29. A job as
a scientist
would be
interesting

30. A
career in
science
would be
dull and
boring

How willing would you be to...?	Very unwilling	Quite unwilling	A little unwilling	Neither unwilling nor willing	A little willing	Quite willing	Very willing
1. "send a letter to the government to ask for more gender equality in schools and working places"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. "sign a letter written by academics to be published on popular newspapers which condemns the denial of women's achievements in science and arts"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. "help organize a demonstration for gender equality in the country"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. "sign a petition to ask for equal number of admissions/career development for women and men in academia"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. "sign a petition to ask for equal number of promotions for women and men in academia"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. "sign a petition to ask for equal number of men and women in scientific committees".	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. "donate money to the cause of gender equality in higher education"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. "ask institutions to increase numbers of bursaries for girls/female adolescents in science"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. “support policies for women’s study leave to improve their education/qualifications in science”.

10. “support national and international events to promote science among girls/women”.

Please answer the following questions

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
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2. Being a man/woman has nothing to do with my identity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I feel strong ties with men	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I feel strong ties with women	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I am very critical of men.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I am very critical of women.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How important do you think it is for Men and Women to be...?

For men:

	Very unimportant	Unimportant	Moderately important	Important	Very important
"honest"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"sincere"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"trustworthy"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"likeable"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"warm"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"friendly"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"competent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"intelligent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"skilled"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For Women:

	Very unimportant	Unimportant	Moderately important	Important	Very Important
"honest"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"sincere"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"trustworthy"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"likeable"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"warm"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"friendly"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"competent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"intelligent"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"skilled"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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website:<https://www.womensaid.org.uk/>

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