Exploring the effects of an identity-safe cue within a gender bias literacy intervention aimed at tackling the underrepresentation of STEM women in academia

Researcher: Chiara Baldo
University of Twente

First supervisor: Bas Kollöffel
Second supervisor: Marlon Nieuwenhuis

Key words: Women underrepresentation, STEM in academia, Diversity & Inclusion, Gender bias literacy interventions, Virtual Reality, Identity-safe cues

Acknowledgments

What started as a Master program turned into an extremely enriching, challenging and eye-opening life journey. You were part of it, so thank you:
Bas, for your humanity and for affording me the freedom to experiment with my ideas while also providing me with fundamental guidance when such freedom would get overwhelming.
Marlon, for the critical direction you gave me at the beginning of this project and for lending me your “fresh eyes” at the very end, when I was lost in my own writing.
Ly, Sjoukje, Ryan and Andy, my amazing film crew.
Fransis and Anke, for being my guinea pigs during the pilot phase and for getting so upset about VRIDS… the experiment worked!
To all the women who voluntarily participated in my study; by talking to you I realised there is an army determined to make society a more just, inclusive space for all.
Daicen, for being the most prepared and patient statistics teacher I have ever had.
Papin, for believing in me, always. And Mami, for keeping me on my toes. Thank you both for supporting me in spite of my at times-unconventional life choices. And Max, for your injections of perspective, wisdom and tranquillity.
Oksana and Jane, for our women circles at the Rocks’.
Saraglia, for constantly making me aware of how precious my victories on this path have been.
Sjoukje, Giulia, Luca and Dayna, for our sacred lunch breaks.
My precious Buddhist community members, for the eternal bonds of friendships we have established as we relentlessly broke through each obstacle.
Luca, for keeping me fed, but truly, for making me feel embraced and for urging me to look at myself through your eyes when self-doubt was blinding me.
Daniel, for the tough-love Sunday night calls and for undergoing such a radical inner transformation while never leaving my side.
And finally, thank you my Lolle for our daily video calling, which kept me sane by allowing me to transcend the isolation and uncertainty of the present times.

Chiara

Abstract

Gender bias leading to the favourable treatment of men over women contributes to the underrepresentation of women in STEM (Science, Technology, Engineering, Mathematics). This can be tackled through gender bias literacy interventions aimed at increasing awareness of gender bias. Nevertheless, augmented awareness may elicit unintended detrimental consequences. For instance, prompting women to become aware of the stereotype connected to their stigmatised identities and the fact that their behaviours may be personally reduced to such stereotype leads to long-term disidentification with STEM. Furthermore, interventions may fail to foster women's belief that they can thrive in spite of sexism and to provide them with strategies to overcome obstacles resulting from their identities. Therefore, interventions need to include identity-safe cues suggesting that women are valued in STEM while providing them with tools to challenge discrimination. The current research investigates the effects of an identity-safe cue on 30 STEM women (divided into three subgroups) at a Dutch technical university within a gender bias literacy intervention. The research question is: What are the effects of the identity-safe cue on awareness of gender bias, belonging and trust, stereotype threat concerns, general negative affect, growth mindset about bias reduction and self-efficacy beliefs to tackle gender bias among STEM women in academia following exposure to a Virtual Reality Intervention for Diversity in STEM? The study, which relied on a quasi-experimental pretest-posttest quantitative design, showed that the ISC was effective in significantly addressing awareness of gender bias, stereotype threat concerns and self-efficacy beliefs. In contrast, belonging and trust, general negative affect and growth mindset were not significantly impacted. Moreover, findings suggest the ISC's effectiveness varied based on the subgroup of reference.

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Gender Bias and the Underrepresentation of STEM Women in Academia

The underrepresentation of women in STEM domains (Science, Technology, Engineering and Mathematics) is well documented (Wang, & Degol, 2016). Such lack of parity is a multidimensional issue that can be explained, among other factors, by still-existing gender biases throughout academia (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012). Gender bias is a stereotype-based bias against women leading to the favourable treatment of men over women (Moss-Racusin et al., 2012). As STEM are perceived as a domains where masculine traits such as agency and assertiveness are required to be successful, this stereotype fuels the perception that women are less competent than men in STEM (Milkman, Akinola, & Chugh, 2015). Moreover, gender bias can be subtle (e.g., forms of benevolent sexism convey the idea that women need to be taken care of), making it harder for individuals to identify and combat unfair treatment. Sexist behaviours that create an unwelcoming environment impair women's advancement and persistence in STEM, consequently preventing these domains from taking advantage of the most talented overall pool of employees (President's Council of Advisors on Science and Technology, 2012).

It is therefore fundamental to address the factors that undermine the recruitment and retention of women in STEM in academia. This can be done by increasing gender bias literacy (e.g., knowledge and awareness of gender bias), considered as a prerequisite for reducing discrimination (Nosek, Banaji, & Greenwald, 2002), as encouraging women to notice subtle bias is imperative for persuading them to combat sexism and support other women (Wang, & Degol, 2016). To do so, gender bias literacy interventions addressing gender biases in STEM are being developed. While previous studies utilised gender bias literacy interventions relying on videos to convey the existence of gender bias in STEM (Hennes, Pietri, Moss-Racusin, Mason, Dovidio, Brescoll, & Handelsman, 2018; Pietri, Hennes, Dovidio, Brescoll, Bailey, Moss-Racusin, & Handelsman, 2018), in the current research a different medium was designed, namely Virtual Reality Interventions for Diversity in STEM (VRIDS). The use of Virtual Reality as a training tool within the Diversity & Inclusion context still needs to be validated. However, given the feelings of presence, immersion and identification VR instils by allowing users to experience events from a first-person perspective and thanks to the high level of empathy it generates (Bertrand, Guegan, Robieux, McCall, & Zenasni, 2018), this medium is likely to create similar, if not greater effects as those elicited by traditional videos.

Nevertheless, by emphasizing existing gender inequities in STEM, such well-intended interventions may act as social identity threat cues for women (e.g., cues suggesting that, due to their gender identity, women will be devalued and therefore do not belong in STEM) (Pietri et al., 2018). A further detrimental consequence of these interventions is the belief that gender bias is insuperable and unchangeable, a belief that fuels an individual's fixed mindset as opposed to a growth mindset (Carr, Dweck, & Pauker, 2012) and which in turn affects individuals' perception of their ability to tackle the issues ay hand (Hennes et al., 2018). As a matter of fact exposing individuals to evidence of a problem without providing concrete tips for addressing it may lead them to feel overwhelmed rather than efficacious (Bandura, 1997). Consequently, to mitigate the unintended negative effects deriving from learning about gender bias in STEM, it is crucial to integrate gender bias literacy training with identity-safe cues (e.g., cues suggesting that women are valued in STEM and which foster women's belief and ability to combat sexist behaviour) (Bandura, 1977). To this end, the current study involved the further development and testing of a pre-existing identity-safe cue (ISC) that draws inspiration from the ISCs utilised in Hennes et al., (2018) and Pietri et al., (2016, 2018)'s studies.

The goal of the current study can be observed from both a social and an educational standpoint. From a broader societal perspective, this intervention can be regarded as a contribution to the gender equity process aimed at compensating for women's historical and social disadvantages, which have prevented women and men from operating on a level playing field (Bilimoria, & Liang, 2012). Equity as a process leads to equality, in turn requiring equal enjoyment by women and men of decision-making processes and access to economic and social resources (Bilimoria, & Liang, 2012). From an educational design perspective, this study aims at investigating ways to develop sounder gender bias literacy interventions, so that they can be utilised as a validated tool within the gender equity process. To illustrate, women's empowerment, a fundamental aspect for the promotion of gender equality, begins by increasing women's awareness of gender bias. When this is followed, for instance, by a reflection on different mindsets gender bias can be tackled with, next to an exploration of the strategies apt to strengthen women's perception of their own agency to reduce bias in STEM, women can become less and less vulnerable to the threat posed by their social identity and acquire or restore their feeling of belonging in STEM disciplines (Hennes et al., 2018; Pietri et al., 2018).

Literature Review

Virtual Reality Interventions for Diversity & Inclusion

Over the past two decades, the potential of Virtual Reality (VR) has been investigated not only from a recreational but also from an educational perspective (Dickey, 2003). In this light, the current research utilises VR as a training medium in the Diversity & Inclusion context (D&I). D&I refers to the strategies and practices aimed at fostering a diverse workplace (e.g., accepting and valuing individuals' differences based on race, gender, disabilities, etc.) and at leveraging the effects of diversity (e.g., increasing the participation and contribution of all employees) to achieve a competitive business advantage (Malach Pines, Lerner, & Schwartz, 2010). Among the multiple factors that make a working environment diverse and inclusive, the current research focuses on the issue of gender equality in STEM.

Origin of the Current Gender Bias Literacy Intervention

Increasing awareness of gender bias and stereotypes in STEM in academia to tackle gender disparity and women underrepresentation can be done, among other strategies, through gender bias literacy interventions. By drawing inspiration from Hennes et al., (2018) and Pietri et al., (2016, 2018)'s previous research endeavours, the current study revolves around the design and partial testing of a gender bias literacy intervention for STEM women in academia aimed at communicating to women the existence of gender bias in STEM while also protecting them from the unintended detrimental effects connected to heightened gender bias awareness. This study's sample is composed of 30 female participants, either Bachelor/Master students, PhD candidates or employees operating in STEM domains at a technical university in the Netherlands.

Differences and similarities between the current study and those by Hennes et al., (2018) and Pietri et al., (2016, 2018) with regard to the use of video interventions to raise awareness of gender bias and the use of identity-safe cues to restore women's perceived fit in STEM will be discussed as follows. Furthermore, building on Hennes et al., (2018) and Pietri et al., (2016, 2018)'s findings, it will be discussed how a certain number of assumptions had to be made with regard to the use of virtual-reality based video interventions relative to six dependent variables. Finally, the testing of the effectiveness of the ISC utilised in the study against the abovementioned variables will be explored.

Traditional Videos versus Virtual Reality

To communicate to women the existence of gender bias in STEM, Hennes et al., (2018) and Pietri et al., (2016, 2018) relied on a set of theoretically grounded 2D videos. Such videos, developed by Moss-Racusin, Pietri, Hennes, Dovidio, Brescoll, Roussos, & Handelsman (2018), are referred to as Video Interventions for Diversity in STEM (VIDS) and represent a validated diversity intervention aimed at conveying the existence of gender bias in STEM. Novel to this study is the use of Cinematic virtual reality (CVR) as a mean to raise awareness of gender bias, which involved the ad-hoc design of a virtual learning environment. To clarify, cinematic virtual reality can be used as an alternative to computer-generated immersive virtual reality environments, which rely on computer generated avatars that users can either identify with or observe from an external perspective (Bertrand et al., 2018). Drawing inspiration from Moss-Racusin et al., (2018), this newly created immersive video is hereinafter referred to as VRIDS (Virtual Reality Intervention for Diversity in STEM). While still relying on video, VRIDS differentiates itself from traditional videos because of heightened feelings of immersion, presence and identification it is likely to prime in users (Bertrand et al., 2018; Oh et al., 2016). Immersive 360-degree VR videos are considered to have a promising educational potential as they greatly increase users' sense of immersion (e.g., by providing surroundings convincingly enough to suspend disbelief and allow full engagement with the created environment) and presence (e.g., the perception of being physically present in a non-physical world) (Oh, Bailenson, Weisz, & Zaki, 2016). A correlation is in fact shown between presence and a positive empathic response, which further demonstrates the power of immersive VR to retain users' full attention on the stories of other individuals (Oh et al., 2016). This is achieved, for instance, by placing users in the first-person perspective of the other (Bertrand et al., 2018), a necessary condition for the body ownership-illusion to occur (Maselli & Slater, 2013). In conclusion, it can be said that traditional videos and cinematic virtual reality videos potentially instil lower and higher levels of users' emotional and mental engagement respectively. Consequently, it is being acknowledged that the unique power of emerging virtual reality technology not only stimulates awareness, but also provides cognitive behavioural training to equip individuals with the necessary skills to deal with bias in the workplace (Oh et al., 2016).

Assumptions

Another fundamental difference between Hennes et al., (2018) and Pietri et al., (2016, 2018)'s studies and the current one lays in the fact that the former tested the effect of their video interventions whereas the latter did not. Measuring the effects of VRIDS would have taken this research beyond the scope of a Master thesis and priority was given to the testing of the effects of the identity-safe cue instead, results which are described in the coming section. In spite of not measuring the effects elicited by VRIDS it was decided to still employ it as part of the intervention. To do so, however, a certain number of assumptions had to be made and this was done according Hennes et al., (2018) and Pietri et al., (2016, 2018)'s findings. To illustrate, by exposing participants to their video interventions Hennes et al., (2018) and Pietri et al., (2016, 2018) recorded an increase in awareness of gender bias but also noticed that this positive outcome simultaneously mediated unintended negative effects. More specifically, they noticed that the narrative portrayed in the videos negatively impacted participants' feeling of belonging and trust in STEM while increasing stereotype threat concerns and general negative affect (social identity threat) and that videos increased a fixed mindset about bias reduction in STEM while decreasing self-efficacy beliefs to tackle gender bias in STEM. In the current research is therefore assumed that VRIDS, juts like VIDS, increases gender bias literacy, decreases feelings of belonging in STEM while increasing stereotype threat concerns and general negative affect, decreases growth mindset and self-efficacy beliefs.

Holding such assumptions as valid within the current research framework is made possible by recognising the fact that the biggest difference between VRIDS and VIDS lays in the method they are administered through rather than in their content and purpose. In conclusion, even though the effects of VRIDS were not measured, the researcher assumed VRIDS would yield similar effects as those elicited by traditional videos employed by Pietri et al., (2016, 2018). If anything, thanks to the high level of empathy immersive virtual reality generates (Bertrand, Guegan, Robieux, McCall, & Zenasni, 2018), this medium is likely to create similar, if not greater effects as those elicited by traditional videos.

VRIDS as Equaliser

Opting to retain VRIDS as an integral part of the present study's intervention without however measuring its effects first-hand rests in the role VRIDS plays within the intervention. To

illustrate, VRIDS acts as an equalising environment to immerse participants in at the beginning of the experiment. The aforementioned equalising aim of VRIDS is that of creating a common base for all participants who are now going to be exposed to exactly the same experience with regard to the meaning and consequences of gender bias in STEM. This, in turn, allows the researcher to collect more stable and reliable data when testing the effectiveness of the ISC to buffer the previously assumed unintended negative effects instilled in participants by VRIDS with regard to the six variables under study. Failing to do so might lead to a high degree of variation among participants, as in each of them could come in with their own unique understanding and potential misconceptions about the meaning of gender bias. The six tested variables are discussed later in this review of literature.

When placed in the context of gender bias literacy interventions, the main aim of VRIDS is to increase participants' gender bias literacy. Consequently, the VRIDS's script was written to include the four main gender bias mechanisms identified in literature. A more detailed description of how each bias manifestation is integrated in the VRIDS' script can be found in appendix C.

The VRIDS' script is based on a real chemistry-related PhD research currently being conducted at a Dutch technical university, it consists of two scenes (coffee machine and boardroom) and was recorded over two days (pilot and final shooting) with the help of a professional documentary films director and four amateur actors (including the researcher). The VRIDS was edited with Adobe Premiere with the support of the BMS Lab.

A summary of the plot goes as follows. GreenEnergy, a well-known energy company, has issued an international research tender. Sam is the postdoc that objectively deserved to win the tender. As a result Sam is going to join the research team at a Dutch technical university, which has agreed to partner with GreenEnergy over a 3-year research project to investigate the potential of a new type of sugar-based biofuel to be tested on Formula 1 cars. The VRIDS depicts the first meeting between Willem (the university's research project coordinator) and Sam (the postdoc). An initial misunderstanding sets the tone of the whole narration: having never met in person, Willem assumes that Sam is a male chemist. When Willem realises that Sam actually stands for Samantha, a negative shift in Willem's perception towards Sam and the whole situation occurs. From this point on, Sam is exposed to bias manifestations and discriminatory behaviours.

Recording this cinematic virtual reality video using a Samsung Gear 360 degree camera attached to the torso of the actress who played Sam allows participants to experience the narration from a first-person perspective, namely that of Sam, further enhancing feelings of immersion, identification and embodiment.

The VRIDS introduction for participants and the VRIDS script can be found in Appendix A and B while the actual video can be found on the following link: https://www.youtube.com/watch?v=sNOaCbxVobA&feature=youtu.be. For the VRIDS' features to be enjoyed fully, a VR-compatible phone and VR headset are necessary.

Six Constructs under Study

Novel to the current study, while Hennes et al., (2018) and Pietri et al., (2016, 2018) either focused on gender bias literacy and social identity threat or on bias literacy, growth mindset and self-efficacy beliefs, the current experiment combines the observation of all six variables simultaneously and investigates how those are affected by the ISC which, in the experiment, follows participants' exposure to VRIDS. A brief overview of the variables is given below.

Awareness of gender bias. Gender bias manifests itself through prejudiced thoughts or actions originating from the gender-based perception that women are not equal to men in rights and competence (Moss-Racusin et al., 2012). Gender bias results in unequal expectations and treatment in employment opportunity (e.g., recruitment, promotion, pay) consequently undermining skilled female and minority scientists while preventing full access to talent (Wang, & Degol, 2016). Making women aware of (subtle) gender biases against women is critical for persuading them to tackle sexism and help other women (Ellemers, & Barreto, 2009). This is defined as awareness of gender bias (Pietri et al., 2018) and is rooted in the idea that communicating explicitly about the non-obvious aspects of gender biases is a prerequisite for motivating positive behavioural change (Pietri et al., 2018). Increasing awareness of gender bias and stereotypes in STEM to tackle gender disparity and women underrepresentation can be done through, among other strategies, gender bias literacy interventions.

According to the stereotype that women are less competent than men in STEM, women are likely to be subject to increased social identity threat. This translates into a cue suggesting women will be devalued due to their gender identity (Steele, Spencer, & Aronson, 2002), which may in turn signal to women that they do not belong in STEM environments (Pietri et al., 2018).

Social identity threat is related to the following three sub-constructs: belonging and trust, stereotype threat concerns and general negative affect.

Belonging and trust. This refers to diminished feeling of trust and belonging, or the belief that women will not be accepted or feel at ease in STEM (Pietri et al., 2018). According to Walton and Cohen (2011), social belonging is a psychological factor that, if lacking, contributes to gender inequalities. Social belonging or, in other words, a sense of having positive relationships with others, is a fundamental human need whereas social isolation harms one's well-being as well as intellectual achievement. Due to the fact that women's gender identity is often negatively stereotyped and marginalized, they may doubt whether they will be fully accepted and included in positive social relationships in male-dominated environments (Walton, & Cohen, 2011). As it is established that belonging uncertainty can undermine minorities' performance (Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002) and health (Blascovich, Spencer, Quinn, & Steele, 2001), social belonging consequently represents a psychological lever connected to which targeted interventions could yield benefits of great breadth (Walton & Cohen, 2011).

Stereotype threat concerns. This construct is defined as the fear of being judged or treated based on the negative gender stereotype targeting a woman's social identity (Davies, Spencer, Quinn, & Gerhardstein, 2002). Stereotype threat has indeed been identified as one of the links between gender stereotypes and women underrepresentation in STEM as such mechanism has the power to compromise stigmatised individuals' aspirations and performance in the given domain (Steele et al., 2002). Steele et al., (2002) explain that every person can be regarded as the unique amalgamation of numerous social identities such as gender, race, religion, level of education etc. Societal attitudes determine the stereotype held towards certain identities in any given situation and individuals tend to consider themselves precisely based on the social identity that is most stigmatised in a given context (Steele et al., 2002). Women are aware to be generally perceived in society as, for instance, irrational, indecisive and bad with numbers. This is an example of a negative stereotype that communicates the stigmatised individuals in question the elements that diminish their group's social identity (Davies, Spencer & Steele, 2005). Similarly, men become vulnerable to stereotype threat in context requiring social sensitivity (Leyens, Désert, Croizet, & Darcis, 2000). If stereotype threat fosters gender disparities in male-dominated domains, it follows that, by removing stereotype threat vulnerability, women's interest in the

given domain is restored, which, in the longer run, should decrease women's underrepresentation accordingly (Davies et al., 2005).

General negative affect. This construct refers to the class of negative emotions women experience (e.g., feeling "threatened" and "anxious") when engaging with existing gender inequalities (Pietri et al., 2018). Pietri et al., (2018) show that knowledge about one's stigmatised identity can have detrimental consequences for psychological well-being. For example, women who are aware of gender bias or who engage with sexist individuals and believe that gender bias is widespread tend to report lower self-esteem and higher depressive symptoms (Schmitt, Branscombe, Kobrynowicz, & Owen, 2002).

Growth (versus fixed) mindset. Another detrimental consequence of gender bias literacy interventions rests in their potential to trigger or reinforce stigmatised individuals' belief that gender bias is insuperable and unchangeable. In other words, exposing participants to the pervasiveness and persistence of biases may stimulate a fixed mindset about bias reduction (i.e., perceptions that bias is stable and can not be decreased) (Carr et al., 2012). As the target of prejudice, women can hold one of the following two beliefs about prejudiced individuals and the malleability of their gender prejudice: a fixed belief (e.g., not believing that others can change or, in other words, that prejudice is fixed) or a malleable belief (e.g., believing that others can change or, in other words, that prejudice is malleable). Rattan and Dweck (2010) explain that holding a fixed belief makes a person more likely to avoid people who express prejudice and more anxious about being subject to unchangeable prejudice, which results in failing to communicate anti prejudice norms while impacting psychological well-being together with negative implications for social and professional interactions. On the contrary, a malleable belief makes individuals more likely to confront explicit prejudice and less likely to avoid a person who made a biased statement on the basis of a single interaction, which in turn affords the opportunity to educate the speaker as well as for professional and social interchange while remaining hopeful and persevere in STEM domains rather than disidentifying with them (Czopp, Monteith, & Mark, 2006; Rattan & Dweck, 2010). A growth mindset (i.e., the perception that bias can be changed) is therefore fundamental for addressing bias. Holding a growth mindset about bias reduction is also of great importance for those who hold prejudice against women. For example, people who have a growth mindset about bias reduction are more likely to participate in strategies that reduce their personal biases (e.g., bias-reduction training or by taking the perspective of a stigmatized group) (Carr et

al., 2012; Neel & Shapiro, 2012) and are also more likely to combat unfair treatment by others (e.g., confronting an individual who makes discriminatory comments) (Rattan & Dweck, 2010).

Self-efficacy beliefs. Bias literacy is characterized, among other factors, by feelings of self-efficacy to address gender bias (e.g., beliefs about one's ability to recognize and tackle issues) (Good & Abraham, 2011). However, when learning about the pervasiveness and persistence of biases, individuals are likely to consider prejudice as a social norm, which hinders motivation to detect and address bias in others or oneself (Duguid & Thomas-Hunt, 2015). In fact, merely providing information about a problem may result in making recipients feel hopeless and ignore the message (Bandura, 2004). Promoting self-efficacy is therefore critical as individuals are not likely to engage in positive change and address harmful sexist actions if they do not believe to have the ability or tools to change their, or others' behaviour (Bandura, 1977).

Identity-safe Cues

In their experiments Hennes et al., (2018) and Pietri et al., (2016, 2018) paired VIDS with four different ISCs to mitigate the unintended negative effects elicited by VIDS. To illustrate, Hennes et al., (2018) and Pietri et al., (2016, 2018) established that, next to gender bias literacy interventions' potential to induce positive outcomes such as increased gender-bias awareness, they also inevitably expose women to stereotypical examples society holds about them. While at first it may appear counterintuitive, such exposure is however necessary as enhanced gender awareness is a prerequisite to the achievement of mindset or behavioural change in participants (Pietri et al., 2018). Having established that such "healthy" awareness potentially also triggers social identity threat while reducing growth mindset and self-efficacy beliefs, it follows that gender bias literacy interventions must include measures aimed at mitigating such unintended negative effects (Davies et al., 2005). The design of identity-safe environments revolves around ensuring women that their stigmatised social identity does not represent an obstacle to success in the given domain while allowing them to comfortably function in situations perceived as otherwise threatening (Davies et al., 2005). According to Rattan and Ambady (2014), identity-safe cues can be both internal to the organisation (e.g., high female representation) or external (e.g., interventions stating scientifically grounded facts that disprove the unfounded basis of the stereotype itself while communicating that women can be successful in spite of sexism) (Davies et al., 2005).

Drawing inspirations from the above studies, the current research paired VRIDS to an ad-hoc designed external ISC, which can be found in Appendix D, with the aim to test its effectiveness on STEM women in academia with regard to the six variables discussed above. The main element that differentiates this ISC from pre-existing ones lays in the fact that, while Hennes et al., (2018) and Pietri et al., (2016, 2018) designed and tested four separate ISCs, namely the "Overcoming bias" and "Role mode" articles together with two versions of Module UNITE (one for female STEM faculty and one for the general population, both male and females), the current study integrated all of them into one ISC (in the form of a PowerPoint presentation) specifically geared towards women studying or working in STEM domains in academia. Beside this integration effort, the "upgraded" ISC also includes new material. Design choices were grounded in literature and will be discussed later on this section. Moreover, as both VRIDS and the ISC were designed ad hoc, this allowed the researcher to create a mirroring mechanism between the two, as in the bias mechanisms and themes touched upon in the VRIDS are later elaborated by the ISC. This allowed for content consistency between the equalising VRIDS experience and the ISC and contributed in the gathering of more accurate measurements with regard to the six variables under scrutiny.

Hennes et al., (2018) and Pietri et al., (2016, 2018) are not the only authors who established that identity-safe cues (i.e., cues suggesting that one's identity will be valued in an environment and that women's threatened identities will not impede positive outcomes) can help buffer the harm arising from diversity interventions (Davies et al. 2005; Walton, Murphy, & Ryan, 2015). In light of such consensus the researcher relied on the literature discussed below to inform the restructuring of the ISC employed in this study. Similarly to Hennes et al., (2018) and Pietri et al., (2016, 2018)'s studies, this external ISC was utilised to increase the previously assumed positive effect of VRIDS on awareness of gender bias while also addressing the previously assumed unintended negative effects elicited by VRIDS on social identity threat, growth mindset and self-efficacy beliefs. It was therefore designed so that it addresses, one by one, the aforementioned variables by conveying the overall message that obstacles will not impede women's growth and development in STEM and that their threatened identities will not impede positive outcomes (Walton et al., 2015).

Keeping in mind Hennes et al., (2018) and Pietri et al., (2018)'s insight on the effectiveness of the "Overcoming bias" and "Role mode" articles and both Module UNITE, the

researcher's intent was to further ameliorate such pre-existing ISCs. For instance, in order to increase **awareness of gender bias** the ISC provides empirical evidence of gender bias in STEM yet in a more detailed and organised way by clearly identifying the four types of gender biases acknowledged by the scientific community, namely "prove it again", "shifting criteria", "double bind" and "maternal wall" (Correll, 2017; Hitting the Maternal Wall-Before They Reach a" Glass Ceiling" in Their Careers, Women Faculty May Hit a" Maternal Wall", n.d.). Each bias manifestation is then paired with specific and concrete action points STEM women can take to cope and strive in academia in spite of sexism.

As mentioned above, the ISC addresses the **social identity threat** construct and its three sub-constructs, namely belonging and trust, stereotype threat concerns and general negative affect. Some slides are dedicated to strengthening feelings of predicted **belonging and trust** by assuring individuals that their stigmatised social identities are not a barrier to success in targeted domains and that they are welcomed and valued whatever their background (e.g., reporting how other female scientists have improved their situation by making friends and allies with male colleagues together with a professor's testimonial who, made aware of his own bias, designed more inclusive classroom environments). For example, Walton et al., (2015) found that feelings of belonging and trust increased by communicating women that all engineering majors initially experience obstacles and loneliness yet such hardships decreases over time as society is becoming more accepting of their stigmatised group (Rattan & Ambady, 2014). The ISC also aims at eliminating, or at least decreasing, vulnerability to **stereotype threat** by challenging the validity, relevance or acceptance of negative stereotypes linked to stigmatised social identities (e.g., there is no difference between men and women in quantitative domains) (Davies, Spencer & Steele, 2005). Moreover, while a gender bias literacy intervention acts as an external cue triggering women's stigmatised social identity and its corresponding stereotype, identity-safe cues embedded within the same intervention can communicate to women that, in spite of the acknowledge bias, they do not run the risk of being individually reduced to a negative stereotype directed at their social identity (Davies et al., 2005). In turn, women can focus on expressing their full potential instead of worrying about acting out the negative stereotype and about the fact that in the workplace people will draw conclusions about their ability based on the performance of other females or that people will draw conclusions about their whole gender group based on a single female's performance. Furthermore, identity-safe environments not only cope with stigma,

they also embrace it by, for instance, stating scientifically grounded facts that disprove the infondata basis of the stereotype itself (e.g., there is absolutely no difference between men and women in quantitative domains) (Davies et al., 2005). To decrease **general negative affect** the ISC advocates that adversity and difficulties will improve and can be overcome (e.g., "Yes, it was difficult at first and sometimes it still is, but things get better… as women we are creating our own support networks, which help us to cope…"), as general feelings of optimism suggesting that, in the near future, attitudes towards female scientists will improve and people will become more accepting of their group can mitigate the harmful outcomes linked to enhanced recognition of bias against the in-group (Kaiser, & Miller, 2004; Rattan & Ambady, 2014). In fact, encouraging women to consider the information presented in VRIDS as a challenge (i.e., they possess the resources necessary to succeed at a difficult task) rather than as a threat is likely to yield more positive emotional reactions to VRIDS (Mendes & Jamieson, 2011).

With regard to the detrimental effects of gender bias literacy interventions on **growth mindset** about bias reduction, this ISC aims at communicating that bias is malleable and that, if individuals have the motivation, they can decrease their biases (Carr et al., 2012; Neel & Shapiro, 2012). In fact, as Rattan and Dweck (2010) explain, it is important to make STEM women aware that mindsets are just beliefs and that, while being powerful beliefs, they inhabit our minds and individuals do have the choice to change their mind.

Self-efficacy beliefs to tackle gender bias is strengthened not only by exposing participants to evidence of a problem, such as the existence of gender bias in STEM, but also, and especially, by providing concrete strategies for combating the problem (Hennes et al., 2018; Walton et al., 2015). This is done to prevent participants from feeling overwhelmed rather than efficacious. Promoting self-efficacy is critical because people may not address harmful sexist actions if they do not feel that they have the ability or tools to change their or others' behaviour (Bandura, 1977).

Experimental Design, Research Question and Model

The current study follows a quantitative pretest-posttest design relying on six quantitative measures to quantify the effects of the identity-safe cue within a gender bias literacy intervention. As this study aims to examine the effects of the identity safe cue (treatment) on women in STEM with regard to six dependent variables, the experiment involves obtaining a pretest measure of the outcomes of interest prior to administering the treatment, followed by a posttest on the same

measures after the treatment occurs (Salkind, 2010). Besides strictly content-related reasons (gender bias), the use of VRIDS allows testing participants' reactions in a realistic and standardised situation or, in other words, it places all participants on the same level of understanding of gender bias before measuring the effects of the ISC. Moreover, immersing participants in VRIDS twice (once before the pretest and once after the posttest) allows the researcher to observe whether participants respond differently to VRIDS after the treatment. In other words, interviewing subjects following the second exposure serves as a means to further measure the effectiveness of the ISC (e.g., Does the presumed effect of VRIDS change over time/after the treatment?).

While short semi-structured interviews are carried out in the final phase of the experiment, they are not part of the main units of analysis and are only used to better interpret previously gathered quantitative data. Such understanding will inform considerations on limitations and future research suggestions.

Based on the above theoretical framework the current research examines the ISC's potential to increase awareness of gender bias and belonging and trust and to decrease stereotype threat concerns and negative affect while increasing growth mindset and self-efficacy beliefs of women in STEM. This leads to the following hypotheses, research question, sub questions and model.

Research question: What are the effects of the identity-safe cue on awareness of gender bias, belonging and trust, stereotype threat concerns, general negative affect, growth mindset about bias reduction and self-efficacy beliefs to tackle gender bias among STEM women in academia following exposure to a Virtual Reality Intervention for Diversity in STEM?

Hypothesis 1: The ISC increases awareness of gender bias in STEM.

Hypothesis 2: The ISC restores women's perceived fit in STEM by alleviating social identity threat. This is done by increasing feelings of belonging and trust while decreasing stereotype threat concerns and general negative affect.

Hypothesis 3: The ISC augments women in STEM's growth mindset about bias reduction in STEM.

Hypothesis 4: The ISC augments women in STEM's self-efficacy beliefs to address gender bias in STEM.

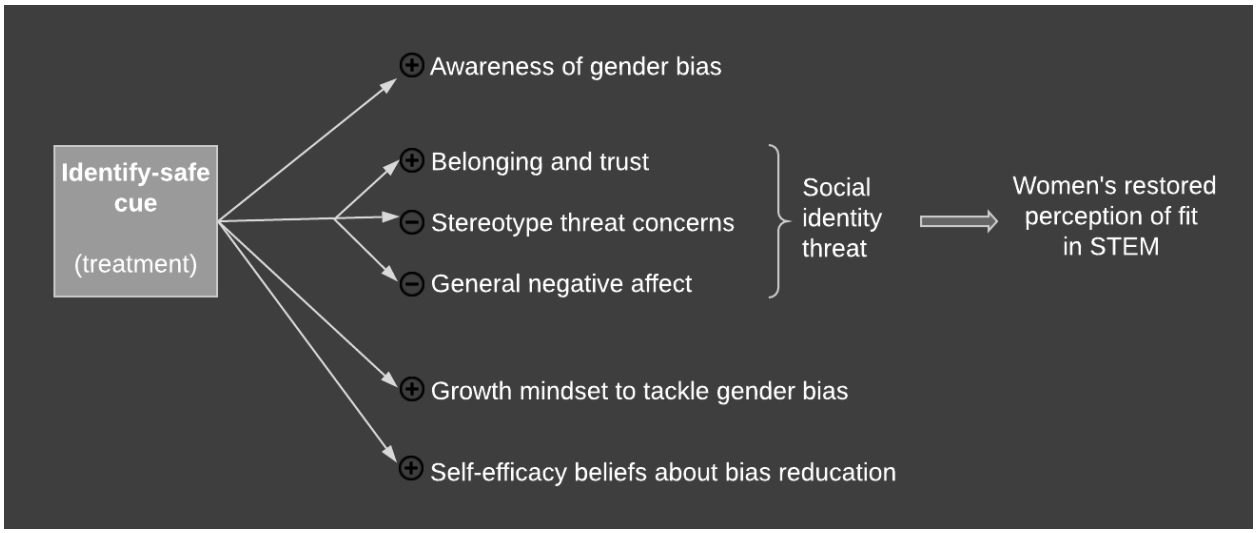
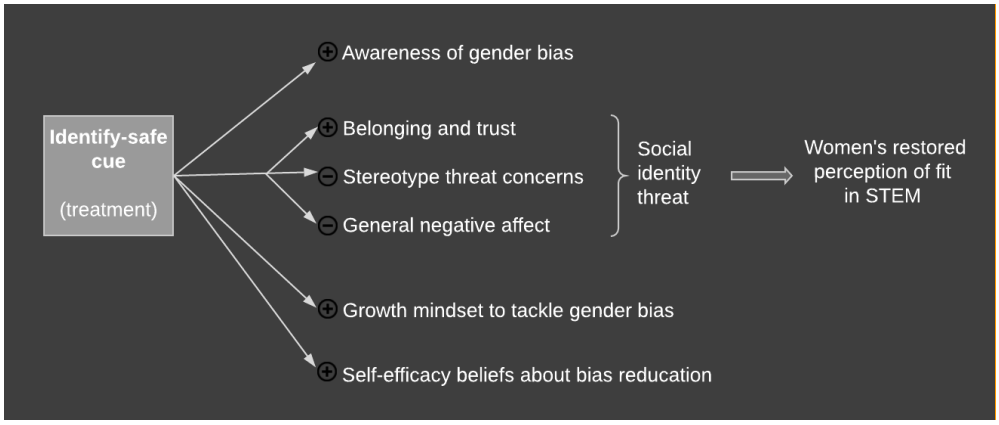


Figure 1. Effects of the ISC on the six variables under study.

Figure 1 exemplifies the effects of the external identity-safe cue on the six variables under study and the way the ISC aims at (re)establishing women's perception of fit in STEM.



Method

Participants

According to a non-random sampling method, this study's sample comprised only women studying or working in STEM domains at a Dutch technical university where data collection took place. The sample is divided into three subgroups: Bachelor/Master students (subgroup 1, consisting of 11 participants, or 36.7%), PhD candidates (subgroup 2, consisting of 12 participants, or 40%) and employees (subgroup 3, consisting of 7 participants, or 23.3%). The reasons why the sample only includes women are as follows. Firstly, women are more frequently

the targets of social identity threat in STEM domains (Moss-Racusin et al., 2012; Pietri et al., 2018). Secondly, female scientists are more likely than are women from the general population to undergo diversity interventions (Pietri et al., 2018), which in turn exposes them to a higher chance of experiencing social identity threat together with reduced growth mindset and self-efficacy beliefs about combating gender bias (Holleran, Whitehead, Schmader, & Mehl, 2010; Richman, Vandellen, & Wood, 2011).

The sample was composed of thirty participants. Johanson and Brooks, (2009) affirm that thirty representative participants from the target population is a reasonable sample size for a pilot study involving the adaptation of existing scales and which investigates the feasibility of the study itself. Moreover, samples with sizes ranging from ten to thirty still allows for precision and accuracy and, while a larger sample size guarantees higher levels of precision, the nature of the sample rather than its size is more important in terms of accuracy (Johanson, & Brooks, 2009).

Measurement Instruments

Through a pretest–posttest design, the study utilised six Likert scales (ordinal measurement scales) to gain in-depth understanding on the effects of the identity-safe cue in increasing or decreasing the six dependent variables under study. As the abovementioned scales were previously developed, authors were asked for permission of use, which was granted for all instruments.

Bias literacy. This construct was examined with eight items assessing participants' awareness of gender bias in science (e.g., "In my opinion women in STEM are not taken as seriously as their male colleagues"). The above statement is part of an adaptation of Pietri et al., (2018), which originally read "In my opinion women in science fields …". "In STEM" was used across all questions/statements when prompting participants to reflect on the general context, whereas "at this university" was utilised to allow participants to relate specifically to their experience at the technical university in the Netherlands where data collection took place.

Social identity threat. This construct was measured using the following three scales, one for each sub-construct. First, belonging and trust, taken from Pietri et al., (2016) was adapted by reducing the number of items from twelve to eleven and by replacing the word "people" with "colleagues" in items one and two (e.g., "Colleagues at this university would be a lot like me"). Second, stereotype threat concerns, taken from Pietri et al., (2016), was measured with two items (e.g., "At this university people will draw conclusions about my whole gender group based on my

performance"). Third, general negative affect was measured with nine items asking participants to rate how much they feel certain emotions, such as “anxious” or “happy” when thinking about combating gender bias in STEM. The first three items (threatened, anxious, worried) were taken from Pietri et al., (2018), while the remaining six were taken from Stroebe, Dovidio, Barreto, Ellemers, & John’s (2011) scale measuring depressed affect (Wang, Stroebe, & Dovidio, 2012).

Growth (versus fixed) mindset. This construct was measured with three items (e.g., “People have a certain amount of gender bias and they really can’t do much to change it”) grounded in the Lay Theories of Racial Bias Scale (Neel, & Shapiro, 2012) which, for consistency reasons, was reworded to refer to gender bias in STEM, when it originally read “gender bias in the sciences” (Hennes et al., 2018).

Self-efficacy beliefs. This construct was assessed using Van Zomeren, Saguy, and Schellhaas’s (2012) four-item Individual Self-Efficacy Scale, adapted to refer to gender bias in STEM (e.g., “I believe that I, as an individual, can reduce gender bias in STEM”) (Hennes et al., 2018). Across all measurements, participants rated their level of agreement (1 = strongly disagree, 5 = strongly agree) with each item. Refer to Appendix E for the full questionnaire.

Semi-structured interviews. At the end of each experiment, a short semi-structured interview was conducted to integrate quantitative findings. The questions aimed at measuring the ISC’s general learning effectiveness (i.e., exploring whether participants’ response to VRIDS changed over time/after the treatment). The semi-structured interview also aimed at measuring self-efficacy beliefs and predicted behavioural change as well as trust and belonging and predicted perseverance in STEM domains. Finally, the semi-structured interview focused on the participants’ perception of VR properties (e.g., immersion, presence, identification, body ownership). Refer to Appendix F for the complete list of interview questions.

Procedure

Prior to data gathering, the Ethical Committee of the University of Twente granted its permission for this study. Before completing the above mentioned scales, respondents were asked for consent, informed on the purpose of the study and asked to state their status (e.g., BSc, MSc, PhD, employee) and STEM domain (e.g, engineering), providing an approach for categorising responses by the corresponding level of advancement in their respective STEM domain.

The intervention was conducted in a dedicated room on the University of Twente’s premises through the use of portable equipment (e.g., VR goggles and I-phone 8X to expose

participants to VRIDS and to record semi-structured interviews, personal computer for ISC administration and data gathering). Each intervention had a duration of maximum 75 minutes.

The experiment began by immersing subjects in the VRIDS environment for the first time, followed by the administration of the pretest (questionnaire). Participants were then exposed to the ISC in the form of a PowerPoint presentation, followed by the administration of the posttest (questionnaire). Participants were then immersed in the VRIDS environment for the second and last time. The final part of the experiment was constituted by the semi-structured interviews. Lastly, each participant had the opportunity to ask questions about the study and express any feeling of discomfort the intervention may have caused, was thanked and offered the possibility for further contact and to receive the final report of the study.

Data Analysis

Data analysis of the quantitative data was conducted with the assistance of the statistical analysis software platform IBM SPSS Statistics 24 by directly importing into it respondents' answers, which were previously collected via the web-based survey tool Qualtrics.

The steps taken to prepare the gathered data for data analysis are as follows. First, collected data were exported from Qualtrics to SPSS. Second, data were cleaned in SPSS by deleting irrelevant data (Log) and by reversing negatively worded questions in the following measures: awareness of gender bias items 1, 3 and 8; belonging and trust, items 4 and 6; general negative affect, item 7. There were no missing data in the dataset. Third, respondents were grouped according to their status within the university: subgroup 1 (Bachelor/Master students), subgroup 2 (PhD candidates) and subgroup 3 (Employees: Postdoc/Researchers/Assistant professors). Fourth, items were aggregated into a latent variable, one for each of the six constructs. For instance, awareness of gender bias consisted of eight items. Calculating the mean of all the eight items resulted in the average level of awareness of gender bias across all participants regardless of pretest/posttest, with higher scores indicating higher levels of awareness of gender bias. To measure stereotype threat concerns, participants' scores were averaged to each of the two items, with higher scores indicating higher levels of stereotype threat concerns. Participants' responses were averaged to each of the eleven and nine items utilised to measure belonging and trust and general negative affect, with higher scores indicating higher levels of belonging and trust and general negative affect respectively. Participants' responses were averaged to each of the three items utilised to measure growth (versus fixed) mindset, with

higher scores indicating higher levels of growth mindset. Participants' ratings were averaged to each of the four items utilised to measure self-efficacy beliefs, with higher scores indicating higher levels of self-efficacy beliefs. The short semi-structured interviews, conducted and recorded at the end of each experiment, were not transcribed. A posteriori, each participant's recording was replayed and notes were taken to create an initial, non-exhaustive qualitative colour-coding scheme. Data were approached based on a concept-driven method, meaning that, according to an informally developed system of codes based on the six variables under study, concepts and ideas were searched for in the recordings and then categorised (Gibbs, 2008).

Results

The current research sought to investigate the effects of an identity-safe cue, administered in the form of a PowerPoint presentation within an overarching gender bias literacy intervention, in positively increasing awareness of gender bias while addressing the previously assumed unintended negative effects triggered precisely by increased awareness of gender bias.

Description of Study Variables

The descriptive statistics showed mean and standard deviation of variables including awareness of gender bias, belonging and trust, stereotype threat concerns, general negative affect, growth mindset and self-efficacy beliefs. Thirty female participants were involved in this study. A correlation of -0.49, p = .01 between belonging and trust and general negative affect indicates a moderate negative association. The descriptive statistics and analysis are shown in Table 1.

Table 1
Pearson's Correlations and Descriptive Statistics of Study Variables.

Variables	*1*	*2*	*3*	*4*	*5*	*6*
1. Awareness of gender bias						
2. Belonging and trust	.21					
3. Stereotype threat concerns	.10	-.06				
4. General negative affect	-.04	-.49*	.28			

5. Growth mindset	-.09	-.27	-.30	-.16		
6.Self-efficacy beliefs	-.14	-.07	-.15	.07	.19	
M	.13	.18	-.10	-.17	-.17	.23
SD	.35	.55	.72	.43	.81	.45

Note. *M* and *SD* are used to represent mean and standard deviation respectively.
*$p < .05$

Instruments' Reliability

As the current study relies on multiple Likert scales, six separate Cronbach's alpha tests were run to measure the scales' internal consistency and to therefore determine the instruments' reliability. Gender bias awareness, 8 items (Cronbach's $\alpha = .64$, which indicates a low, yet still acceptable level of internal consistency. Belonging and trust, 11 items (Cronbach's $\alpha = .79$), indicating a moderate level of internal consistency. Stereotype threat concerns, 2 items (Cronbach's $\alpha = .83$), which indicates a high level of internal consistency. General negative affect, 9 items (Cronbach's $\alpha = .85$), which indicates a high level of internal consistency. Growth mindset, 3 items (Cronbach's $\alpha = .82$), indicating a high level of internal consistency. Self-efficacy beliefs, 4 items (Cronbach's $\alpha = .93$), which indicates a high level of internal consistency.

Instruments' Validity: Investigating Variable Relationships for Complex Concepts

An exploratory factor analysis restricted to six factors, which is considered to be a reliable questionnaire evaluation method, was conducted to test the construct validity of the different measures employed in the present study. Not surprisingly, given that all the employed measures are existing scales validated in previous research, the factor analysis fully confirmed the validity of the instruments. Having looked at the six factors the analysis is restricted to and which represent the six variables under study, the total variance explained relative to all the items responses is .69 Given the small sample size, in this context anything greater than .60 represents a rather solid result (Hair, Black, Babin, & Anderson, 2013). All six components' Eigenvalues are greater than 1, making them strong factors. Factor 1 was comprised of 8 items reported on a 5-point Likert scales that explained 21.59% of the variance with factor loading from .41 to .85. Factor 2 was comprised of 11 items reported on a 5-point Likert scales that explained 37.19% of

the variance with factor loading from .59 to.83. Factor 3 was comprised of 2 items reported on a 5-point Likert scales that explained 48.99% of the variance with factor loading from .53 to .61. Factor 4 was comprised of 9 items reported on a 5-point Likert scales that explained 58.23% of the variance with factor loading from .38 to .88. Factor 5 was comprised of 3 items reported on a 5-point Likert scales that explained 65.17% of the variance with factor loading from .56 to .95. Factor 6 was comprised of 4 items reported on a 5-point Likert scales that explained 68.68% of the variance with factor loading from .84 to .87. Only two factors in item 6, which refers to the general negative affect construct, did not have a particularly high factor loading as in, they did not score too well. More specifically these factors relate to the general negative affect measure item 1 ("To what extent do you feel threatened when thinking about combating gender bias in STEM?") and item 7 ("To what extent do you feel happy when thinking about combating gender bias in STEM?"). It can be assumed that such low factor loading derives from participants getting used to the way they had to score items with a negative connotation (e.g., item 1, threatened), while perhaps getting confused by the reversed item (e.g., item 7, happy). Results of the factor analysis can be found in Appendix G, Table 7 and 8.

Assessing Normality of Data Using Skewness

Having established the reliability and validity of the instruments, it is now possible to dive deeper into the collected data. Firstly, z score for skewness (skewness z-value critical value between -1.96 and 1.96, alpha level .05) was employed to confirm whether sample data were normally distributed. It arose that awareness of gender bias (z-score = 1) and stereotype threat concerns (z-score = -.15) follow a normal distribution while belonging and trust (z-score = 5.61), general negative affect (z-score = -2.10), fixed mindset (z-score = 12.34) and self-efficacy beliefs (z-score = 2.93) are not approximately normally distributed. Consequently, differences in awareness of gender bias and stereotype threat concerns between pre and posttest were measured with a paired-sample T-test. The critical value was set at .05 level. Instead, differences in trust and belonging, general negative affect, growth (versus fixed) mindset about gender bias reduction and self-efficacy beliefs to combat gender bias between pre and posttest were measured with a Wilcoxon Signed Rank test. The critical value was set at .05 level.

Comparing Two Groups of Dependent Quantitative Data

All variables increased or decreased as predicted in the hypotheses. Results are shown in Table 2. However, a significant difference was captured only in relation to three variables out of six, namely awareness of gender bias, general negative affect and self-efficacy beliefs. Consistent with hypothesis 1 (The identity-safe cue increases awareness of gender bias in STEM), findings suggest that awareness of gender bias increased significantly after the treatment ($t = 2.09$; $df = 29$; $p = .045$). As per hypothesis 2 (The identity-safe cue restores women's perceived fit in STEM by alleviating social identity threat. This is done by increasing feeling of belonging and trust while decreasing stereotype threat concerns and general negative affect), stereotype threat concerns decreased but not significantly ($t = 0.76$; $df = 29$; $p = 0.455$). The Wilcoxon signed-rank test showed that the ISC was not effective in significantly increasing belonging and trust ($z = -1.05$; $p = 0.296$) while it was effective in significantly decreasing general negative affect ($z = -2.14$; $p = 0.033$). As per hypothesis 3 (The identity-safe cue augments women in STEM's growth mindset about bias reduction in STEM), the Wilcoxon signed-rank test findings report an increase, although not statistically significant, in growth (versus fixed) mindset after the treatment ($z = -1.68$, $p = 0.093$). Consistent with hypothesis 4 (The identity-safe cue augments women in STEM's self-efficacy beliefs to tackle gender bias in STEM), the ISC was effective in increasing self-efficacy beliefs ($z = -2.47$, $p = 0.013$). Results of both parametric and non-parametric tests are shown in Table 3 and 4.

Table 2

Comparing Differences between Pretest and Posttest across All Dependent Variables.

	Pretest				*Posttest*			
Variable	*M*	*SD*	*Minimum score*	*Maximum score*	*M*	*SD*	*Minimum score*	*Maximum score*
Awareness of gender bias	3.06	.68	1.88	4.50	3.19	.72	1.75	4.50
Belonging and trust	3.24	.97	1.27	5.00	3.42	.83	1.18	4.82
Stereotype threat concerns	3.17	1.11	1.00	5.00	3.07	1.01	1.00	5.00
General negative affect	2.33	.88	1.11	4.11	2.15	.74	1.11	4.11

Growth mindset	1.88	.82	1.00	4.00	2.05	.78	1.00	4.00
Self-efficacy beliefs	3.63	.86	1.00	5.00	3.85	.64	2.00	5.00

Note. *M* and *SD* are used to represent mean and standard deviation respectively.
All variables were measured on a scale from 1 to 5.

Table 3
Mean Difference Relative to Awareness of Gender Bias and Stereotype Threat Concerns.

Variable	*M*	*SD*	*Minimum score*	*Maximum score*	*T-test*	*p*
Awareness of gender bias	.13	.34	.00	.26	2.09	.045
Stereotype threat concerns	-.10	.72	-.37	.17	-.76	.455

Note. *M* and *SD* are used to represent mean and standard deviation respectively.
*$p < .05$

Table 4
Mean Difference Relative To Belonging And Trust, General Negative Affect, Growth Mindset And Self-Efficacy Beliefs.

Variables	*Z*	*p*
Belonging and trust	-1.046[b]	.296
General negative affect	-2.135[c]	.033
Growth mindset	-1.682[c]	.093
Self-efficacy beliefs	-2.474[b]	.013

*$p < .05$

The Wilcoxon Signed Rank test also provided some interesting data on the comparison of participants' before (pre) and after (post) scores with regard to the two non statistically significant results among the four non normally distributed variables under study. Relative to belonging and trust, for example, we can see from Table 5 how 43% of participants reported a higher belonging and trust score after the treatment. With regard to growth (versus fixed) mindset about the malleability of gender bias, the Wilcoxon Signed Rank test points towards the inability of the ISC to positively affect this particular unintended negative effect as only 16% of participants reported a higher score after the treatment. It is however worth mentioning that the score of 36% of participants remained unchanged after the treatment. Refer to Table 5 for results.

Table 5

Rank Differences between Pretest/Posttest Relative to Belonging and Trust and Growth Mindset.

Variables	*N*	*Mean rank*	*Sum of rank*
Belonging and trust	Negative	9[a]	10.50
	Positive	13[b]	12.19
	Ties	8[c]	
	Total	30	
Growth mindset	Negative	14[g]	9.75
	Positive	5[h]	10.70
	Ties	11[i]	
	Total	30	

While conducting semi-structured interviews with each participant, an unexpected pattern emerged that prompted the researcher to notice that the sample naturally divided itself into three subgroups: Bachelor/Master students (subgroup 1, consisting of 11 participants, or 36.7%), PhD candidates (subgroup 2, consisting of 12 participants, or 40%) and employees (subgroup 3, consisting of 7 participants, or 23.3%). Consequently, it seemed important to determine if there were statistically significant differences between these three subgroups based on the way participants responded to the intervention under scrutiny.

Assessing for Significant Differences on Continuous Dependent Variables

However, before determining whether there were statistically significant differences between these previously identified three subgroups, equality of variance had to be checked in order to establish which statistical test to run. A parametric Levene's test verified the equality of variances in the sample (homogeneity of variance) ($p > .05$) on the variables that were previously identified as normally distributed. As both awareness of gender bias and stereotype threat concerns' p values are greater than alpha equality of variance is assumed, meaning that a one-way ANOVA (analysis of variance, alpha set at .05 level) test can be run to measure for potential differences across these three subgroups originating from the subjects' status within the University of Twente, that is Bachelor/Master students (subgroup 1), PhD candidates (subgroup 2) and employees (subgroup 3). No significant results emerged from the analysis of variance relative to awareness of gender bias ($p = .856$) and stereotype threat concerns ($p = .941$), suggesting that there is no difference across different subgroups with regard to these two variables.

While there is not a minimum sample size for ANOVA, these non-significant results may be related to low statistical power due to small sample size (subgroup 1 = 11 (36.6%); subgroup 2 = 12 (40%); subgroup 3 = 7 (23.3%)). Perhaps meaningful differences would have emerged had the subgroups been bigger. A further practical issue with one-way ANOVA is that unequal sample sizes can affect the homogeneity of variance assumption, even if, according to Keppel and Wickens, (2004) a good rule of thumb is lacking for the point at which unequal sample sizes make heterogeneity of variance a problem. Nevertheless, within the scope of the current research, the collection of further data to increase statistical power while obtaining more equal sample sizes was not possible due to time limitations.

A non parametric Levene's test was used to verify the equality of variances in the samples (homogeneity of variance) ($p > .05$) on the variables that were previously identified as non-normally distributed: belonging and trust ($p = 0.528$), general negative affect ($p = 0.296$), growth mindset ($p = 0.557$), self-efficacy beliefs ($p = 0.557$). All p values are greater than alpha, set at .05 level, therefore assuming equality of variance. These results show that it is possible to run a Kruskal-Wallis H test for the non-normally distributed variables. Nevertheless, one of this test's assumptions had to be checked first to verify whether the distributions of these four dependent variables for the subgroups are differently shaped (different variability allows to compare mean ranks) or similarly shaped (same variability allows to compare median ranks). According to the histograms and boxplots all four dependent variables are differently shaped so a Kruskal-Wallis H test can be carried out to compare the means of the dependent variables (e.g., belonging and trust) for the different subgroups (e.g., bachelor/Master, PhD and employees). Nevertheless, the Kruskal-Wallis H test showed that there was not a statistically significant difference in belonging and trust, general negative affect, growth mindset and self-efficacy beliefs between the three different subgroups.

CVR Technological Affordance

The current research utilised cinematic virtual reality (CVR) as a learning environment aimed at evoking specific responses in participants based on Hennes et al., (2018) and Pietri et al., (2016, 2018)'s previous studies. The data presented in Table 6 were collected during the semi-structured interviews and show that, besides body ownership, most participants experienced a high level of mental and emotional engagement with the narrative portrayed in the CVR. More specifically, it arose that 93% of the subjects felt fully immersed in the VRIDS, as in they felt

fully engaged with the events taking place in the CVR environment. 70% of subjects reported a complete degree of presence (having the perception to be physically present in the VRIDS non-physical world). Similarly, 70% of participants reported high levels of identification, as in the ability to feel the emotions in Sam's head while being immersed in the CVR. Of slightly less significance, only 33% of subjects reported a feeling of body ownership (feel like Sam's body was their own body while immersed in the CVR), which is likely to be due to the rather rudimentary way the CVR aimed at conveying a sense of body ownership. To this regard, more sophisticated technology such as a more appropriate 360 degree camera for VRIDS recording could easily overcome this issue.

Table 6

Levels of Immersion, Presence, Identification and Body Ownership while Immersed in CVR.

	Immersion: (While in the CVR did you feel fully engaged with the events taking place or were you thinking about what was going on outside the CVR, so in the room, outside etc.?)	Presence: (While in the CVR, did you have the perception of being physically present in that non-physical world?)	Identification: (While being immersed in the CVR could you feel the emotions in Sam's head?)	Body ownership: (While being immersed in the CVR did you feel like Sam's body was your body?)
Yes	28 (93.3%)	21 (70%)	21 (70%)	10 (33.3%)
Moderately		5 (16.6%)	5 (16.6%)	3 (10%)
No	2 (6.6%)	4 (13.3%)	4 (13.3%)	17 (56.6%)

Discussion and Conclusion

The following section dives deeper into the meaning behind the numbers presented above and relative to each of the six variables under study. As two out of four hypotheses were confirmed, the focus will be on reflecting about possible reasons behind the unexpected results obtained in relation to the unconfirmed hypotheses. Firstly, however, it is important to mention that the current research positions itself as the continuation of the studies conducted by Hennes et al., (2018) and Pietri et al., (2016, 2018) and why this is of importance for the interpretation of

the current findings. In the process of testing their gender bias literacy intervention, Hennes et al., (2018) and Pietri et al., (2018) measured the effects of a set of articles and videos for diversity in STEM, shedding light on both their positive and negative effects. The current study utilised a similar tool as that employed by Hennes et al., (2018) and Pietri et al., (2016, 2018), namely virtual reality intervention for diversity in STEM (VRIDS) yet, while they focused predominantly on the effects of the videos, the current study focuses on the effectiveness of the ISC and on ways to further improve it. While the employment of VRIDS was deemed as necessary to familiarise participants with the nature and extent of gender bias in STEM, no baseline measures relative to the six constructs under scrutiny were collected before exposing participants to VRIDS, which consequently forced the researcher to apply Hennes et al., (2018) and Pietri et al., (2016, 2018)'s findings relative to the effects of videos for diversity in STEM and to assume that VRIDS will have yielded similar effects.

Awareness of Gender Bias

Findings suggest that awareness of gender bias increased significantly after the treatment. Thus, consistent with Hypothesis 1 (The identity-safe cue increases awareness of gender bias in STEM), the ISC was effective in boosting the previously assumed positive effect of VRIDS, which led to greater awareness of gender bias.

Social Identity Threat

The current research sought to investigate whether the identity-safe cue was effective in decreasing social identity threat by increasing feeling of belonging and trust while decreasing stereotype threat concerns and general negative affect. (Hypothesis 2. The identity-safe cue restores women's perceived fit in STEM by alleviating social identity threat).

Belonging and trust. Belonging and trust increased after the treatment, but not significantly. These findings suggest that the potential effectiveness of the ISC was not fully maximised in terms of augmenting women's perception of being welcomed and valued in STEM domains. Such results are below expectations as four slides out of twenty seven were included in the ISC to specifically address this construct and choices in the design of the ISC were made based on the strengths and weaknesses identified in the ISC previously utilised by Pietri et al., (2016, 2018). As attested by previous research efforts that measured the detrimental effects of video interventions for diversity in STEM on belonging and trust (Pietri et al., 2018), the current

research confirms that a negatively impacted sense of belonging and trust may be easier to trigger than to control and to effectively mitigate with this type of external identity-safe cue.

According to several authors (Brown & Pinel, 2003; Mendoza-Denton, Page-Gould, & Pietrzak, 2006), this could be explained by participants' stigma sensitivity, a construct that determines the degree to which discriminated-against individuals experience negative outcomes related to instances of prejudice. The higher the level of one's stigma sensitivity, the higher their chances to experience negative events. Individuals with high levels of stigma sensitivity are more likely to look for cues in their environment confirming expectations about their stigmatised status or to react more strongly to instances of prejudice, which in turn can reduce trust and increase feelings of belonging uncertainty (Brown & Pinel, 2003). Belonging uncertainty can be triggered by multiple environmental factors or events and even extremely subtle cues as long as the event causes the individual to question their social ties (Walton, & Cohen, 2007). Furthermore, results of Walton and Cohen (2007)'s study suggest that feelings of belonging uncertainty occur even in contexts where there is no concern of being stereotyped and no fear of negative feedback. This last statement could explain why, even within the clinical setting in which the experiment took place, which was thought of as a rather safe and unthreatening space for women, the ISC did not manage to buffer the presumed negative effects of VRIDS on belonging and trust. For instance, to eliminate as many threatening cues from the ISC while safeguarding the ISC's ability to raise gender bias literacy by openly describing STEM's state of the art when it comes to gender inequality, the ISC was integrated with extracts from the "Overcoming bias" article previously utilised by Pietri et al., (2018) and which had proven effective at strengthening belonging and trust (see slide 18 in Appendix D). Furthermore, some of the cues contained in the "Overcoming bias" article about how severely prejudiced the situation is (e.g., "The problem does not appear to get better. If anything, these women report more unfair treatment in their fourth year") were removed as this cue not only proved ineffective, but also augmented stereotype threat concerns and negative affect. Because of the rather blatant way bias manifestations are portrayed in the VRIDS (which is nevertheless necessary to raise awareness of gender bias), an a posteriori analysis makes the researcher assume that subjects who are very sensitive to prejudice were left severely affected by the VRIDS' content. While the ICS aimed at buffering such negative reactions, perhaps its counterbalancing effect was not strong enough for subjects reporting a high degree of stigma sensitivity, which in turn could explain why the ISC raised their levels of

belonging and trust yet not significantly. Adams et al., (2006) also found that prolonged exposure to environments in which women are a minority or are stigmatized may make women more aware or alert to the possibility of experiencing negative events. Cohen and Garcia (2008) continue by saying that if people perceive that a negative stereotype is linked to their identity, and consequently experience identity threat or belonging uncertainty, that specific identity is more likely to be engaged and, if contextual cues confirm a threat to it, they are more likely to underperform.

To address low feelings of belonging and trust, Seaton, Williams and Ashburn-Nardo, (2012) maintain the strength of social ties and the degree to which an individual receives social support may positively impact academic and career outcomes as well as psychological well-being. To this end, extracts from the "Overcoming bias" article previously utilised by Pietri et al., (2018) were integrated in the ISC and were used to describe how a cohort of STEM women found that making friends and allies with male colleagues was a strategy that helped them to feel like they belonged to a community. The ISC also aimed at communicating that adversity and difficulties will improve and can be overcome, as Walton et al., (2015) found that women in engineering felt more belonging and comfort after being made aware that all engineering majors initially experience difficulties and loneliness, but that it gets better and these difficulties decrease over time (Appendix D, slide 19, 20). Rattan and Ambady (2014) suggest that individuals from stigmatized groups also feel comforted by a message suggesting that in the near future people will become more accepting of their group. For the above-mentioned reasons the ISC aimed at communicating general feelings of optimism and stressed the fact that thanks to the efforts of both men and women, gender bias in STEM is decreasing (Appendix D, slide 7).

While the ISC employed in this study aimed at conveying the message that support networks are being built around women in STEM and that even in biased environments women can find support and allies in both their male and female colleagues, it is assumed that experiencing social support first-hand has a greater positive effect than reading about others experiencing social support. The aforementioned can be described as activities that require regular and continuous in-person engagement and it may be underlying a gap that an external ISC could find hard to bridge. For instance, Mendoza-Denton et al., (2006) found that mentoring and cross-group friendships are manifestations of social support that contribute in reducing the detrimental effects of prejudice on belonging and trust. To further stress the relevance of one's

social environment and ties, Seaton et al., (2012) mention factors such as the number and quality of female role models in one's relevant STEM field, one's degree of similarity to those who are successful in their same field and one's general judgment of "fit" in their field as responsible in predicting women's feelings of belonging and trust in such disciplines. It appears that the factors identified by Seaton et al., (2012) can be more successfully included in an external ISC without requiring first-hand experience by the participant. Nevertheless it is believed that an ISC can be successful in communicating these types of messages as long as they refer to, for instance, existing role models participants can personally connect to and, in general, are tailor made to the specific environment participants operate in and where they are at risk of experiencing low belonging and trust.

Correlation between low belonging and trust and high social identity threat. As the gathered qualitative data show, the ISC was not effective in significantly increasing subjects' belonging and trust as well as in decreasing social identity threat. According to Cohen and Garcia (2008), individuals who identify with a stigmatized group are likely to establish in-group and out-group comparisons, which in turn make them very sensitive to issues of belonging. Hogg, Terry, and White (1995) continue by saying that social identity threat occurs when one's social identity becomes salient within a specific context and when that identity is perceived to be of possible negative evaluation (e.g. according to stereotype, African Americans are considered as less capable in academia, which is likely to make an African American person who enters academia engage with this stereotype and consequently feel that his/her social identity is at threat). Seaton et al., (2012) conclude this line of reasoning by saying that, as negative feedback can undermine the sense of belonging of a group that is of minority status in the environment, individuals who experience identity threat can also experience belonging uncertainty. The establishment of such correlation may explain why the ISC failed to protect women from both belonging uncertainty and stereotype threat concerns.

Stereotype Threat Concerns. In spite of the efforts to strengthen the effectiveness of the ISC, stereotype threat concerns decreased but not significantly. While these findings suggest that this effect remains difficult to effectively buffer with an external ISC, it would be of value to understand possible reasons behind this ISC's weakness. To this end, Davies, Spencer and Steele (2005) explain that, on the one hand, if stereotype threat fosters gender disparities in male-dominated domains, it follows that by removing stereotype threat vulnerability women's interest

in the given domain is restored, which, in the longer run, should address women's underrepresentation accordingly. On the other hand, Steele and Aronson (1995) argue that prompting individuals to focus on their stigmatised social identities and corresponding stereotypes increases their concern of being devalued in those specific contexts. As Pietri el al., (2018) also confirmed, an indirect negative effect of raised gender bias literacy is that of prompting women to think that they may be potentially evaluated based on their gender. In this study, the two items that measure stereotype threat concerns ask women to rate the likelihood for people in their workplace to draw conclusions on their ability based on the performance of other women as well as the likelihood for people in their workplace to draw conclusions on other women's ability based on their own performance. It can consequently be expected that, having just engaged with a highly-biased and highly-immersive cinematic virtual reality scenario where the main female character's abilities are blatantly disregarded only on the basis of her gender, answering these questions can make participants focus even more on the possibility to be exposed to this very same threat. Nevertheless, Pietri et al., (2018) also state that the ISC's goal should not be that of eliminating such expectations. Rather, in order to allow gender to represent less of a threat for women in the workplace, an effective ISC should communicate to women that such threat concerns will not prevent them from being successful in their STEM careers.

To this end, this ISC drew inspiration from Davies et al., (2005) who found that, while priming women to think about their stigmatized identities can expose them to the insidious effects of stereotype threat (which is what VRIDS supposedly does), eliminating vulnerability to stereotype threat from targeted domains can protect stigmatized individuals' aspiration and performance. In this context, vulnerability to stereotype threat is activated by knowledge of the stereotype linked to one's threatened identity and the knowledge that one risks being personally reduced to that stereotype in the targeted domain (Davies et al., 2005). So, in order to design an ISC that assures women that their stigmatized identity is not a barrier to success in targeted domains, this ISC intended to challenge the validity and relevance of negative stereotypes linked to their stigmatized identity (Davies et al., 2005). It has to be noted however that only one slide in the PowerPoint Presentation forming the ISC was dedicated to conveying that scientific research has repeatedly disproven the stereotype undermining women's ability to perform at the highest level in STEM fields (see slide 17, Appendix D). Furthermore, one of the two statements in the slide refers to a study performed on seven million boys and girls in grades 2 through 12 in the

US, which fails to specifically address women in STEM. While reinforcing the unfounded basis of the stereotype seems like a valuable avenue to decrease stereotype threat concerns, a more effective ISC should perhaps stress this point further while using examples and scientific data women in STEM can more directly relate to.

Given the overarching goal of the current research to identify sound diversity interventions design principles that address the problematic underrepresentation of women in STEM, it made sense to draw inspiration from Davies et al., (2005)'s research focusing on disidentification as one of the causes that eventually lead to underrepresentation. Their research is based on a model according to which women vulnerable to stereotype threat make use of pre-emptive strategies, as in short-term strategies resulting in domain avoidance (e.g., I will stay in academia but I will focus on teaching instead of researching, as teaching is considered as a safe terrain in which women are valued and welcomed), followed by permanent strategies resulting in domain disidentification (e.g., I will avoid STEM altogether as it is a field where I risk being personally reduced to a negative stereotype) (Davies et al., 2005). This is an important mechanism to be aware of as the adoption of such strategies leads to differences between men and women with regard to their aspirations and accomplishments in a given domain, which is often mistakenly interpreted as some form of gender-related inability and which closely resembles existing misconceptions in STEM. They concluded that establishing an identity-safe environment removes vulnerability to stereotype threat despite exposure to threatening situational cues that activate stigmatized social identities (Davies et al., 2005). Nevertheless, having underestimated the factor that Davies et al., (2005)'s successful experiments were conducted in the leadership domain, as opposed to the STEM domain, may be at the root of this ISC's failure to protect women from stereotype threat concerns. While both leadership and the hard sciences remain male-dominated domains, for an identity-safe cue to be effective for STEM women in academia it would perhaps require more domain-tailored background research resulting in the design of a more ad-hoc message that can be relevant to women operating in these specific fields.

General Negative Affect. General negative affect decreased significantly. These findings suggest that the ISC was effective in restoring women in STEM's psychological well-being (e.g., lower self-esteem, higher depressive symptoms) associated with knowledge about one's stigmatised identity, engagement with sexist individuals and the belief that gender bias is widespread. These findings can be considered a modest yet meaningful step forward as

previously utilised ISCs were not effective in buffering such negative emotions (Pietri et al., 2018). This may be due to the effort to ameliorate the previously utilised ISC by integrating a greater number of more specific and concrete tips women can apply to cope and be successful in STEM in spite of still existing gender biases, together with communicating general feelings of optimism (e.g., women creating their support networks), as such measures can mitigate the harmful outcomes correlated to enhanced recognition of bias against the in-group (Kaiser, & Miller, 2004).

Growth (versus Fixed) Mindset

As per hypothesis 3 (The identity-safe cue augments women in STEM's growth mindset about bias reduction in STEM), the current research sought to investigate whether the ISC was effective in increasing growth (versus fixed) mindset about the malleability of gender bias. Results however point towards the inability of the ISC to positively affect this particular unintended negative effect. Nevertheless, it is worth mentioning that the growth mindset score of over two-thirds of participants remained unchanged after the treatment, meaning that the ISC was ineffective yet it can be derived that the VRIDS did not exacerbate participants' fixed mindset, or the belief that bias is immutable.

The ISC's weak performance may be linked to the audience of reference of this intervention, namely females, which in STEM happens to be the target of gender discrimination. This is not to undermine the importance of encouraging women to have a growth mindset about gender bias reduction. In fact, it is recommended to do so by informing them about the benefits of changing their own beliefs about the malleability of others' prejudice while simultaneously informing them that individuals holding a gender biased view can, if willing and motivated, overcome their bias. However, it must be taken into account that, on top of receiving a message reiterating that, as women, they are the target of gender discrimination, also being asked to go the extra mile to control and change a rather legitimised sense of resistance and avoidance towards biased individuals can result in a daunting and overwhelming task. While still opting to encourage them to hold an optimistic perspective in spite of gender inequality, it can be expected of discriminated-against women to struggle in adopting a growth mindset about bias reduction, precisely because the greater cause of discrimination is an external one, which therefore remains mostly out of their control. In light of the above mentioned it could be assumed that for women to hold such a growth mindset about bias reduction, the input of this ISC is not sufficient.

Nevertheless, it is also worth mentioning that in a previous study Hennes et al., (2018) succeeded in mitigating the unintended negative consequence of their gender-bias literacy intervention on women's fixed mindset with regard to bias reduction through the use of an ISC similar to the one utilised in the current study. What differentiates the two is the media utilised. In the former, traditional 2D videos were responsible for negatively impacting women's growth mindset about bias reduction. To this regard Pietri et al., (2016) found that videos increased participants' identification with characters and immersion in the story while evoking feelings of transportation. In other words, as these videos' content increases caring about the characters, who are victims of bias, the narratives lead participants to feel upset and uncomfortable about the situation at hand, which in turn may lead them to project back onto themselves the discrimination experienced by the victim in the narrative. As a result participants may associate STEM domains with heightened feelings of threat than prior to being exposed to the gender bias literacy intervention. As an alternative to traditional videos, the current study used cinematic virtual reality (CVR) in the form of an immersive 360º video which, compared to the former, is believed to further enhance audience experience and engagement levels. Consequently, combining Hennes et al., (2018) and Pietri et al., (2016)'s findings in relation to the mechanism triggered by videos with literature relative to the feelings of immersion (Bertrand et al., 2018; Oh et al., 2016), presence and identification CVR triggers, it can be derived that while sending the appropriate message aimed at making women aware of the fact that gender bias is malleable, negative effects were more severely experienced by the participants and the ISC conveyed growth mindset prompts with disproportionately low power when considering the powerful level of engagement triggered by the VRIDS.

Self-efficacy Beliefs

The current research sought to investigate whether the ISC was effective in increasing subjects' self-efficacy beliefs to tackle gender bias following exposure to VRIDS. Consistent with hypothesis 4 (The identity-safe cue augments women in STEM's self-efficacy beliefs to address gender bias in STEM), self-efficacy beliefs increased significantly.

While it has already been established that the major driving force behind such improvement revolves around the ISC providing STEM women with pragmatic and realistic points they can act upon in their everyday working-life, it can also be assumed that exposure to vicarious experience played a positive role. This is to say that, while some participants may have

not yet faced the challenge and successfully accomplished "the task" of personally tackling gender bias in their work place, witnessing other in-group women succeeding at it may have indirectly benefitted their perception relative to their own ability to eventually triumph as well.

Patterns Emerged from the Semi-structured Interviews

While conducting 15-minute semi-structured interviews at the end of each experiment, differences in the effect of treatment across three participant subgroups based on their status within the university became manifest, clusters which had not been hypothesised prior to conducting the experiments. Although the results obtained through the analysis of variance are not significant, next to the fact that the qualitative data gathered from semi-structured interviews are not considered as the main unit of analysis of this study, an informal reflection on the patterns emerged is worthwhile as such data yielded some counterintuitive results and could therefore guide future research endeavours, while perhaps adding insight that was simply not captured by the numbers. What arose is that participants reacted differently to the intervention based on their status within the university or, in other words, based on whether they are Bachelor/Master students, PhD candidates or employees (researchers, postdocs, assistant professors). The following section discusses the differences emerged based on each identified subgroup.

Bachelor and Master students' experience of positive discrimination. Of interest is that the semi-structured interviews suggest that out of a total of eleven Bachelor and Master students, without any prompting 63.3% mentioned experiencing positive gender discrimination within the university context. They recounted that representing a minority within their study programs makes them feel smart, special and proud. These participants also reported feeling very supported by teachers and supervisors when seeking help or clarification as well as by the university as a whole thanks to a special introductory program for female students in male-dominated domains, next to their involvement in more informal female students support networks. Moreover, the semi-structured interviews suggest that subjects' general feeling of optimism is also linked to their awareness of the fact that, outside the academic context, companies are trying to attract STEM female employees, which affords STEM female graduates higher chances to get a job in their relevant fields.

The ISC utilised in this intervention greatly increased Bachelor and Master students' level of **awareness of gender bias** in STEM, allowing them to recognise and name the different manifestations of gender bias. The semi-structured interviews suggest that this subgroup was

surprised to learn that nowadays gender discrimination still represents a barrier to women's career development. The intervention also shed light on the fact that gender bias can often be implicit and manifest itself in very subtle, hard-to-notice forms, which in turn prompted some students to reinterpret past events in light of the newly acquired knowledge and awareness.

Perhaps due to their baseline low awareness of gender bias, Bachelor and Master students come across as very confident and willing to speak up in the face of discriminatory behaviour. When asked if and how they would have reacted to the instances portrayed in the VRIDS, most students said that they would have interrupted Willem (the technical university's biased research coordinator), explained to him that there is no correlation between gender and performance in STEM and that they would have not let Mike (non-biased male from the industry) speak on their behalf. Such predicted behaviours denote a high level of **self-efficacy beliefs** in combating gender bias. Furthermore, participants mentioned that being exposed to positive female role models such as their professors also contributes to the belief that they too will be able to succeed in STEM domains.

In terms of **growth (versus fixed) mindset** with regard to whether gender bias is insurmountable and whether biased people can actually transition towards a non-prejudiced view about gender, the semi-structured interviews yielded mixed results. As in, some participants stated that, whether someone's bias is implicit or not, it will not change, while others stated that they were pleased to learn through the intervention that people's mindset can change.

With regard to feelings of **belonging and trust**, participants were asked to rate twice, on a scale from 1 to 10, how much they would like to work in STEM domains, first following the exposure to the VRIDS and then following exposure to the ISC. 45.5% of participants reported a positive change in score (e.g., from 4 after the VRIDS to 6 after the ISC), signalling the effectiveness of the ISC in increasing feelings of belonging and trust in spite of increased gender bias awareness. This is in line with the quantitative data findings showing an increase, yet not significant, in belonging and trust. It is also worth noting that, while participants' scores either increased or remained the same, none reported a lower score after the treatment (ISC). Perhaps this can be traced back to this subgroup's high levels of self-efficacy beliefs in tackling gender bias together with experiences of positive discrimination. It can also be assumed that the participants' relatively young age (early twenties) plays a role as in, having only operated in a STEM educational environment, as opposed to a professional one, participants feel protected,

welcomed and optimistic when considering their current and future perspectives in these domains.

PhD candidates' willingness to change their mind. The most interesting element that arose from the semi-structured interviews with female PhD candidates is the fact that, among the three subgroups, they were the most responsive to the ISC **growth mindset**-related content. This is especially of interest as, by only looking at the quantitative data collected, the ISC resulted ineffective in favouring a growth (versus fixed) mindset. First of all, it is worth summarising the messages conveyed by the identity-safe cue to then reflect on this subgroup's reactions to them. The ISC applied a two-fold approach on growth mindset about combating gender bias. On the one hand, it prompts the participant to self reflect on her own mindset. As the target of prejudice, women can hold one of the following two beliefs about prejudiced individuals and the malleability of their gender prejudice: a fixed belief (not believing that others can change or, in other words, that prejudice is fixed), or a malleable belief (believing that others can change or, in other words, that prejudice is malleable). The ISC explains what are the repercussions and/or benefits of holding either one of these two mindsets (e.g., a fixed belief makes a person more likely to avoid people who express prejudice and more anxious about being subject to unchangeable prejudice, which results in failing to communicate anti prejudice norms while impacting psychological well-being together with negative implications for social and professional interactions. On the contrary, a malleable belief makes individuals more likely to confront explicit prejudice and less likely to avoid a person who made a biased statement on the basis of a single interaction, which in turn provides the opportunity to educate the speaker as well as for professional and social interchange while remaining hopeful and persevere in STEM domains rather than disidentifying with them). On the other hand, the ISC informs participants that prejudiced people can also change and overcome their bias if they are willing and motivated to do so. When asked whether the ISC helped them interpret the VRIDS's characters and behaviours differently, one participant reported that "during the second VRIDS viewing I tried not to be biased about Willem's stereotype against me", suggesting that she adopted a more malleable view of the gender stereotype a person may hold against her. Another participant mentioned that "after the ISC I felt hopeful that gender bias can change and that people around me might gradually see the value of my work". Another one also pointed out that "the ISC made me aware of the fact that my opinion about people can change as well as others' opinion and

stereotype towards me". Another participant said that the only new thing she learnt from the ISC is that people's bias is not fixed, which was contrary to her previous belief and experience. She appreciated learning that, if willing, people can be educated rather than only forced to behave in a certain way by policies and regulations (e.g., obligatory paternity leave which is meant to allow both genders to compete on fairer grounds). She acknowledged her own fixed mindset and the fact that she has been avoiding biased people. Yet, she added, "as biased people are everywhere, perhaps it is better to believe that they can be educated rather than avoided altogether". Another participant also reported reacting differently to the second VRIDS viewing in terms of her predicted feelings and actions because she learnt that the belief system of biased people can change.

With regard to **awareness of gender bias**, the semi-structured interviews revealed that women in this subgroup are equipped with a higher level of awareness compared with the Bachelor/Master subgroup. In some cases however, the ISC still allowed participants to improve their ability to recognise, name gender bias manifestations and identify appropriate strategies to react to them while also prompting opportunities for reflection and re-interpretation of past events. For instance, a participant first shared how in her research group she does not experience gender discrimination to then become aware of and wonder why in the group there are four male and one female professors.

When asked to compare first and second VRIDS viewing, the main difference that arose is that during the first viewing subjects felt overwhelmed while during the second, after exposure to the ISC, they felt more in control, better at listening, at spotting the manifestation of biases explored in the ISC and at retrieving strategies to respond to them. Even if, according to the quantitative data analysis, the intervention was significantly effective in increasing participants' awareness of gender bias, this specific subgroup reported a low learning effect in relation to the ISC. Nevertheless, some participants reported that the ISC raised their awareness with regard to the maternal wall. This could be linked to the fact that most PhD candidates interviewed are relatively young (mid-twenties) and therefore just approaching the standard child-bearing age in the Netherlands, identified at 29.9 in 2018 (Statistics Netherlands (CBS), 2019). It can be assumed that one becomes more aware of maternal wall bias repercussions once such matter becomes relevant to her individual situation.

In spite of the already conspicuous amount of reading and exposure to gender bias issues reported by this subgroup, such awareness did not prevent participants from finding the tips embedded in the ISC (concrete actions and behaviours to adopt when faced with each of the four gender bias manifestations identified in the ISC) useful and applicable. These participants reported that the application of the tips would mostly occur during meetings and conferences, in which women are likely to represent a minority, and when engaging with lab technicians and supervisors. The aspects they found can be most readily acted upon are the projection of assertiveness rather than uncertainty through posture and the ability to take up space in the room, next to avoiding the use of qualifiers in their speech (e.g., just, maybe, I think, probably, very) and permissions (e.g., may I, sorry, excuse me) as, according to literature concerning the double bind bias manifestation, they can negatively affect perception of competence by suggesting uncertainty or weakness. Participants also found useful the framing of assertive statements with warm opening and closing statements (e.g., behaviour phrase, value phrase, or inoculation phrase) which help reduce the assertiveness backlash by 27% by appearing strong and keeping the substance of their message clear and direct without breaching stereotypes. One participant even self-reflected on her own teaching style and unconscious gender bias as a PhD candidate (e.g., unconsciously focusing her attention on the most outspoken students, which happen to be males and the use of pictures depicting male scientists in her presentations). Altogether these data support why **self-efficacy beliefs** to combat gender bias is one of the variables that increased most significantly thanks to the ISC.

In line with the quantitative analysis, interviews' data confirmed that the ISC was not effective in increasing feelings of **belonging and trust**. Participants were asked to rate twice, on a scale from 1 to 10, how much they would like to work in STEM domains, first following the exposure to VRIDS and then following exposure to the ISC. 33.3% of participants showed a positive change in score (e.g., from 3 after the VRIDS to 6 after the ISC on average), signalling the effectiveness of the ISC, although relative to a rather small percentage of women, in increasing feelings of belonging and trust in spite of increased gender bias awareness. Nevertheless, it is worth noticing that, while participants' scores either increased or remained the same, no decrease was reported. This at least shows that, while perhaps not effective, the ISC managed to keep intact participants' feelings of belonging and trust. Finally, an aspect that

differentiates this subgroup from the Bachelor/Master one is that PhD candidates did not report experiencing positive discrimination.

Employees' resilience fails to be affected by proximity to the glass ceiling. Similarly to the abovementioned subgroup, employees also did not report experiencing positive discrimination. The most salient aspects that arose from the semi-structured interviews of this subgroup composed of 7 participants in their mid-thirties point towards a general feeling of pessimism and disillusionment with regard to the symptoms of gender disparities in STEM and their ability to combat them. This could be linked to these women's longer professional experience in the field, which has exposed them to more numerous gender-related challenges.

With regard to **awareness of gender bias**, participants reported an already high level of awareness prior to the intervention. All of them mentioned having extensive knowledge about gender issues and having participated in gender-bias-related interventions as well as behavioural and impression management training. Only one participant affirmed that the ISC was useful as it refreshed her awareness of gender bias. What is of interest is that she then clarified by saying "I can now remember what troubles me, as we learn to just accept discrimination, even if it bothers us". To this regard another participant stated that gender bias is still an issue in this century and revealed her pessimism when it comes to reaching gender equality in academia. Such pessimism was not detected in the previous two subgroups, which leads to three conclusions. Firstly, however, it is necessary to mention that such conclusions rely solely on an impression the researcher formed based on dialogue with the 30 women involved in this study. First, to increase women's belief that progress is being made in terms of gender equality, they must be shown that males are included in gender-bias literacy interventions from an early stage and that, more generally speaking, if men fail to contribute to the gender equality process, no real change will occur. Second, at this point in STEM women's career in academia, gender bias literacy interventions are not perceived as useful. Third, the more a woman progresses in her STEM career in academia, the closer she gets to what is known as the "glass ceiling", an invisible barrier of discrimination that hinders women's access beyond a certain level in a hierarchy.

One factor linked to the abovementioned sources of pessimism experienced by STEM women in academia could be the fact that, at this point in their careers, most women are likely to develop a desire for motherhood, which in turn pushes them against what is known as the maternal wall. The dynamics revolving around the maternal wall bias are recognised in literature

as one of the main factors resulting in gender pay-gap and underrepresentation of women in high-profile positions (Hitting the Maternal Wall-Before They Reach a" Glass Ceiling" in Their Careers, Women Faculty May Hit a" Maternal Wall", n.d.). In support of this, a participant disclosed the following anecdote: a PhD position was open in one of the university's faculties, where her good friend and colleague conducts research. While, by law, the job description could not mention that the position was only open to male candidates, he told her that he would have in fact disregarded female candidates a priori, given that they might become pregnant during the course of the PhD, which would not allow them to be in the lab for some months, to then go on maternity leave. As a matter of fact this is the subgroup that resonated the most with the maternal wall bias manifestation presented in the ISC. "Being a working mum is like being a bad mum. When I took my maternity leave they could say nothing, but they were not happy" one participant said during the interview. However, when asked whether they could apply any learning acquired in the ISC, none reverted to the maternal wall suggested strategies. This is perhaps because such strategies are not as concrete as the tips given regarding body language and speech, which instead were reported as useful and applicable, or because such strategies have been previously implemented to no avail.

While the ISC was not significantly effective in increasing women's feeling of **belonging and trust**, when asked to rate twice, on a scale from 1 to 10, how much they would like to work in STEM domains, first following the exposure to VRIDS and then following exposure to the ISC, participants reported the highest scores among the three subgroups, ranging between 9 and 10. This subgroup's scores also reported the smallest fluctuation compared to the other two subgroups, as in they reported an average baseline value of 9.3 after the VRIDS, which increased to 9.5 after the ISC. Consequently, while acknowledging their pessimism and the fact that their coping strategy relies on learning to put up with discriminatory behaviours, it appears that the 7 STEM professionals interviewed are not currently at risk of applying the preemptive strategies of domain avoidance and domain disidentification identified by Davies et al., (2005). While this and the fact that women in this subgroup do not seem to be vulnerable to the assumed indirect negative effects triggered by VRIDS is positively welcomed, the fact that women employed in the academic STEM context still remain such a small minority compared with the rest of the academic workforce cannot be ignored. Overall, such results suggest that for an intervention to successfully address the underrepresentation of women in STEM, participants must be

approached at an earlier stage in their academic and professional development, preferably when they do not already represent a stark minority in their field.

Participants in this subgroup responded well to concrete tips linked to the double bind bias manifestation. This is perhaps linked to the fact that subjects reported often having to choose between being warm or bossy and the tips in the ISC offer strategies to overcome such conundrum. These participants reported finding the tips applicable in instances in which they engage with fellow researchers in informal contexts as well as in meetings and conferences where it is important to communicate succinctly and assertively without coming across as aggressive (**self-efficacy)**. One mentioned that the increased awareness afforded by the intervention together with the concrete tips better equipped her to cope with the biased STEM domains when it comes to choosing the appropriate words and style to frame a message. One subject mentioned having already participated in similar interventions and could not find the ISC tips useful. She believes that bottom-up strategies aimed at gender equality are not effective. Instead, she places more trust in policies adopted in countries such as Sweden and Norway where gender equality is part of the political agenda and the issue is addressed through a top-down approach. Two subjects mentioned finding communication-related tips useful yet their overall perspective on, or possible approach to, gender bias was not affected by the ISC. One reported finding the ISC tips relevant yet, rather than this type of "passive" intervention, she would value more a workshop that allows to practice the application of the suggested tips.

Only one participant out of seven responded positively to the ISC messages with regard to **growth mindset**. She reported that "when immersed in the VRIDS for the second time after being exposed to the ISC, I was more aware of the reasons behind the biased character's (Willem) behaviour and of the fact that his bias, rather than being fixed, can actually change". She also mentioned learning from the ISC that she too can adopt a more malleable belief about individuals holding gender prejudice. Only one other participant indirectly referred to having learnt through the ISC about the possibility for biased individuals to transition towards a fairer view of gender in the workplace. She did so by mentioning the fact that the ISC teaches a lot about how women have the power to change, yet says very little about how men can also help. The researcher positively welcomed the feedback nevertheless, due to the scope of this Master thesis, the intervention designed for the current research is only geared towards women. This

being said, men are acknowledged by diversity and inclusion researchers and practitioners alike as essential agents of change should gender equality in STEM be eventually reached.

Correlation between perception of gender bias and country of origin. International Bachelor/Master student and PhD candidates reported that, compared to the gender discrimination experienced in their country of origin such as Mexico, Iran and Portugal, the Netherlands' context appears to give both genders the opportunity to operate on much fairer grounds and that, while gender bias is still existing, here it is perceived on a more subtle level. One of these participants for example reported how, in one of the abovementioned countries, colleagues would openly speak about why pregnant women should not be hired and why women should earn less than men. As mentioned above, while the Netherlands' workplace became more meritocratic over time, subtle biased behaviours still persist. For instance, one of these PhD candidates pointed out that male lab technicians take her less seriously and consider her research and needs less important than those of her male counterparts, which in turn causes delays in her research progress. Such comments point to the fact that, compared to more traditional, patriarchal and male-dominated societies, gender equality in the Netherlands' academic context has advanced to the extent that relocated STEM practitioners do not feel discriminated against compared to women who were born and raised in central and northern Europe and who therefore hold such European standards as their point of reference.

Limitations and Suggestions for Future Research

Due to the scope of the current research, while VRIDS was employed to prompt certain reactions linked to the six variables under study in order to then investigate the effectiveness of the ISC in addressing said reactions, no pretest was conducted before exposing subjects to VRIDS. This meant that the researcher had to assume that VRIDS would yield comparable effects to a similar trigger previously employed by Hennes et al., (2018) and Pietri et al., (2018), namely videos for inclusion in STEM. Nevertheless, instead of traditional 2D videos, the current study relied on cinematic virtual reality which, while being a video, differentiates itself from traditional videos because of heightened feelings of immersion, presence and identification it is likely to prime in users. Consequently, it would be of interest to gather baseline measurements before exposing participants to VRIDS to better understand this fairly recent medium's educational potential as it is assumed that ISCs need to be designed and adjusted taking into

consideration the properties of the awareness-boosting tool selected within the overarching bias literacy intervention.

On a similar note, the current study drew inspiration for Hennes et al., (2018) and Pietri et al., (2018)'s intervention not only regarding the use of video as an awareness-boosting tool, but also on the use of a PowerPoint presentation as the ISC. Nevertheless, the fact that traditional videos and cinematic virtual reality videos potentially instil lower and higher levels of users' emotional and mental engagement respectively cannot be ignored. It could be assumed that an ISC that proves effective when paired with traditional videos may be regarded as weak when paired with immersive technology. Consequently, it would be of interest to, first establish the correctness of the above statement, second to explore to what extent an intervention that relies on cinematic virtual reality requires to be paired with a proportionally powerful ISC and finally what is the design process necessary to take an external Power Point ISC such as this one to the next level.

A quantitative research design was selected for the current research. Next to it, qualitative data were gathered through semi-structured interviews. While insight obtained from the interviews is still mentioned in the main body of this report, such data cannot be relied on as much as the quantitative ones. This is mainly due to the fact that, while recorded, interviews were not fully transcribed and formally coded. It is however worth mentioning that notes were taken during each interview, allowing for a partial coding of the data and which resulted in the identification of themes and patterns valuable for the design and administration of future gender bias literacy interventions. In conclusion, it would be interesting to continue the current line of research while relying on a fully-flagged mixed methodology.

Moreover, while designing the semi-structured interviews' questions, the research considered the possibility for such interviews to act as a systematic mirror to the scales collecting quantitative data. Simultaneously, however, time constraints had to be taken into consideration: the experiment was designed so that it could meet the requirement of a maximum duration of 75 minutes while also aiming not to burden participants with an overly lengthy procedure. Furthermore, because it was thought that scales collecting quantitative data would have yielded sufficient insight, the semi-structured interview was designed so that it could focus on collecting new information. Had time allowed, it would have been interesting to ask participants the

following questions as this could have helped telling the story behind the numbers, especially with regard to the results that did not confirm the initial hypotheses:

1. If any, did your belief that you, as a woman, will not be accepted or feel at ease in STEM change after exposure to the ISC? And why? (Measuring trust and belonging)
2. If any, did your fear of being judged or treated based on the negative gender stereotype (targeting a woman's social identity) change after the ISC? How? (Measuring stereotype threat concerns)
3. If any, did your belief that gender bias is insuperable and immutable change after the ISC? Do you feel like you can reduce bias in STEM? Did your perceived ability to combat unfair treatment by others increased after the ISC? (Measuring growth (versus fixed) mindset about bias reduction in STEM)

From a technical standpoint, the awareness-boosting tool in the form of an immersive 360° video was fully developed by the researcher and while it served its purpose, many aspects of it can be improved. Above all, having recorded the video utilising a 360 Samsung Gear camera negatively impacted participants' sense of embodiment as, after a certain angle, it was possible for the participant wearing the goggles to see the top of the head of the actress who played Sam during the recording. A 360-degree necklace camera or an eyewear 360 camera could solve this issue as they allow to capture a 360 video from a first-person perspective.

Finally, a sample size of 30 participants is considered sufficient to pilot a newly designed intervention. Nevertheless, a bigger sample size together with more homogeneous subgroup sizes would allow the drawing of more meaningful conclusions through the statistical tests utilised.

Overall Conclusion

While at first sight, especially according to the interviews' findings, the intervention designed for the present study might seem premature for the Bachelor/Master students subgroup, a more thorough evaluation actually points in the opposite direction. Even if such participants cannot relate much with the topic as well as the severity and pervasiveness of gender discrimination and its repercussions, the intervention could be seen both as a maintenance as well as a preventive measure. Maintenance in terms of safeguarding this subgroup's existing positive feelings relative to their STEM minority status and prevention in terms of equipping young STEM practitioners to face the difficulties that are likely to arise along their career progression. More specifically, the ISC can focus on preserving the sense of belonging most Bachelor and

Master female students already experience, as sense of belonging has demonstrated to have important implications when it comes to minority students' performance in the academic environment. As those who experience a lowered sense of belonging in STEM fields also feel discouraged from pursuing careers in STEM fields and are more likely to discourage a peer from doing so as well, it can be concluded that, when determined to address the underrepresentation of women in STEM, working with this target population becomes of paramount importance. Moreover, low levels of gender bias awareness prevent women from even recognising instances of gender discrimination and therefore to speak up and defend themselves against them. The glass ceiling is still far for this subgroup's participants yet the intervention proved effective in raising gender bias awareness and in providing some practical tips they can already apply, especially in managing interactions during group work, where they often find themselves to be the only female student.

With regard to the PhD candidates subgroup, the current intervention appears appropriate due to their closer proximity to the glass ceiling. Even if they reported being already aware of gender bias and therefore not learning much from the ISC, the concrete tips mentioned in the ISC were found useful and highly applicable. Furthermore, this subgroup seemed very open to the growth mindset discussion, a topic worth exploring before views and beliefs systems become too rooted to be easily modified.

When looking at the employees subgroup, it appears that administering the current intervention at this stage is too late. This is primarily due to the fact that subjects reported not learning anything new from the ISC as well as having already undergone similar training and gender bias interventions, amounting to an already high level of gender bias awareness. This subgroup participants have already experienced to some extent, directly or indirectly, the glass ceiling while some are already or are likely to soon become mothers, a factor that further hinders a woman's professional development in STEM. One of the biggest challenges diversity and inclusion practitioners will be faced with when designing interventions geared towards this specific target population will be that of dealing with the overall pessimism that characterises their view on the obtainment of gender equality in the workplace. As one assistant professor pointed out: "If you go to the Waaier building, in the mezzanine, you can find the wall of fame where the pictures of all the University's deans are hanging. Can you guess which traits they have in common? They are all white males." This simple statement shows that ISCs aimed at the

retention of women in STEM will need to be solid enough to counterbalance gender biased cues embedded in our everyday life.

The researcher also acknowledges that interventions such as the one utilised in this study play an important role when addressing the underrepresentation of women in STEM yet, given the multidimensionality of the gender-inequality issue, they cannot replace the role played by policies and regulations (e.g., childcare shared responsibility policies) that must be enforced on an institutional level, in the private and public sectors alike, if we wish to grant equal opportunities to both men and women to fulfil their human and professional potential while contributing to scientific innovation and breakthrough. By joining forces, educational scientists and policy makers can contribute to the shaping of learning and social environments in which factors predicting multiple outcomes for women in STEM such as the social ties an individual has, the number and quality of role models, the degree of similarity to those who are successful in their field, and an individual's overall judgment of "fit" in their field have the potential to create a ripple effect that will close more and more today's gender gap.

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Appendices

Appendix A.

VRIDS Introduction to Participants

Dear Participant,

Welcome to *VR MAGIC*!

And thank you for dedicating some of your precious time to this experiment.

You are about to experience a Gender Bias Literacy Training in a cinematic virtual reality environment. But first, let's make sure we are on the same page with regard to the following concepts.

- STEM stands for Science, Technology, Engineering and Mathematics

Gender bias translates itself in

- prejudiced thoughts or actions originating from the gender-based perception that women are not equal to men in rights, dignity and capabilities.

Gender bias turns into gender discrimination (or the favourable treatment of men over women), which results in:

- obstacles to women's equal access and full participation to STEM professional opportunities and rewards (e.g., recruitment, promotion, pay)
- failed access to the overall pool of talented STEM professionals.

A gender bias literacy training is an intervention aimed at

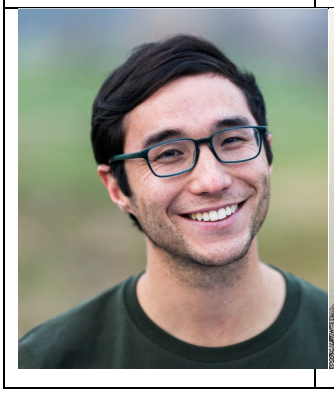
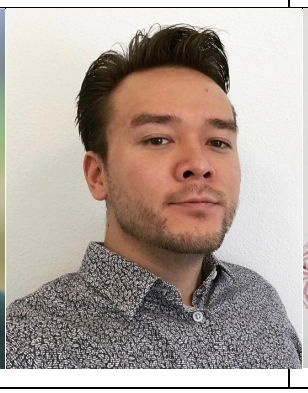
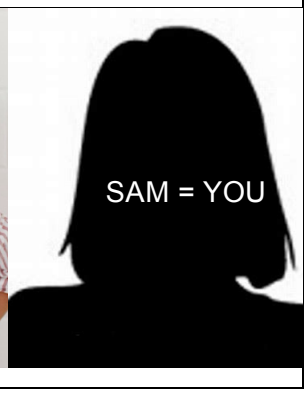
- increasing employees' awareness of gender bias and stereotypes in the hard sciences in order to
- address gender disparity and women's underrepresentation in STEM domains.

Here is a short introduction to the story you are about to be immersed in through a Virtual Reality headset.

The winner

GreenEnergy, a well-known energy company that aims to meet the world's growing need for cleaner energy solutions, has issued an international research tender. Sam is the postdoc that objectively deserved to win the tender. As a result Sam will join the research team at a Dutch

technical university, which has agreed to partner with GreenEnergy over a 3-year research period to investigate the potential of a new type of sugar-based biofuel to be tested on Formula 1 cars.
Today, the first meeting between:
Mike, GreenEnergy's representative (who has been in charge of the researcher selection process);
Willem, the university' research project coordinator (who is looking forward to welcome the new researcher in the team);
Odeassa, Willem's secretary and
Sam, the postdoc (who will join the research team at the technical university and work under Willem's supervision).

Mike GreenEnergy's representative	**Willm** Technical university research project coordinator	**Odessa** Willm's secretary	**Sam** The postdoc
			

The meeting is is taking place today at GreenEnergy's headquarters in Den Haag.
YOU
You will be experiencing the meeting from Sam (the postdoc)'s perspective. Basically, for the next few minutes, you are going to become Sam.
So sit back, relax and enjoy the journey.

Appendix B.

VRIDS Script

ACTORS

1. Mike -in his 40s (GreenEnergy's representative)
2. Willem -in his 50s (technical university's research project coordinator) *While extremely biased towards women in STEM, Willem is a sweet, nice guy. He is unaware of his own bias. He thinks that what he says, even in front of Sam, is just normal. There is neither malice nor irony. He's dressed normally/nerdy, not like a macho.
3. Odessa -in her 40s (Willem's secretary)
4. Sam -in her 30s (Postdoc & tender winner) camera standpoint for condition 1 (victim)

FIRST SCENE *coffee corner (actors: Willem, Sam)*

-Here we see Willem showing his excitement about Sam, the new postdoc he's about to meet. He expects Sam to be a man-

-Willem prepares himself a cup of coffee while speaking over the phone. Sam also happens to walk to the coffee corner to get some tea. They do not know each other and Willem does not notice Sam. Sam unintentionally overhears Willem's conversation and realises Willem is talking about her. Eventually Willem leaves. Sam remains there-

Willem: Yes Denis, thanks for calling me. I received your files and I'm going to get back to you as soon as possible. Yeah, sounds good to me. Anyway, I just got to Den Haag and after lunch I'm going to meet the postdoc who's going to join our Formula 1 biofuel project. You wouldn't believe who we got for this position! This Sam is supposed to be the best in the field.

-Willem pauses briefly to listen to his interlocutor-

Willem: Exactly! With Sam on the team we are going to be a big step ahead of all our competitors. Great, isn't it? Talk to you later, bye.

FADE TO BLACK

SECOND SCENE *interior, meeting room (4 chairs, a table). Mike, Sam and Odessa are sitting. Willem walks in 1 minute later. The 4 of them will be present till the end.*

Odessa: Willem is running slightly late. He really had to take an important phone call but he should be here in a moment. In the meantime let me just introduce myself. I am Odessa, Willem's secretary.

Mike: Hi. Mike, It's a pleasure to meet you. And this is Sam (pointing at her).

Odessa: Hello Sam.

-*They all shake hands*-

-*Meanwhile Willem walks in the meeting room, looking cheerful and energetic, and sits at the table. He doesn't even look at Sam. He only addresses Mike*-

Odessa: There you are, We were just waiting for you.

Mike: Hi Willem.

Willem: Mike, sorry for being late.

Mike: No problem.

Willem: Anyway, I have been really exited the whole week to finally meet Sam. Has he shown up yet?

Mike: Yeah, here she is!

Willem: Oh, YOU are Sam? Sorry, I thought you were Mike's assistant. You look so... young…

Mike: I mean, she's in her early 30s.

Willem: And you are willing to embark on this 3-year endeavour? That is quite ambitious. -*Willem looks at the camera/Sam, yet she cannot say anything as she's just a camera*-

Willem: I guess she does not plan to have a family. –*Willem looks at Mike*-

Mike: Uhm, ok... Anyway, Sam has developed this model for the degradation of sugars in harsh acidic conditions. And I think we are really going to be able to use...

THIRD SCENE

-Willem interrupts Mike-

Willem: Mike, hold on, could I have a quick word with you? Samantha, you could maybe go grab some coffee in the meantime...

Mike: No, I believe Sam should stay. After all she is going to be the one leading this project from now on. So, it's better to keep her in the loop. So, as you both know, we need to decide whether to approach this from a "one-pot" or an extraction perspective.

Willem: Right, we talked about this before and you know my concerns about the efficiency of the extraction, right?

Mike: Exactly, but Sam was able to synthesize long chain alkanes starting from pure fructose in a 3-step process. Right Sam? *-Mike looks at the camera/Sam, yet she cannot say anything as she's just a camera-*

-Willem ignores Sam and only talks to Mike-

Willem: At the lab we routinely work with one-pot batches. We don't trust multistep synthesis on these processes as we run the risk of losing a lot of starting material.

-Mike and Willem don't include Sam in the decision-making process even if supposedly she's going to be leading the research-

Mike: Fair enough. Alright, let's stick to one-pot batches then.

FOURTH SCENE

Willem: Yeah, And if I remember correctly, didn't you say you had shortlisted two candidates for this position?

Mike: Yes.

Willem: Can you remind me of the other candidate's name?

Mike: Adam...

Willem: Right, Adam. What were his shortcomings again?

Mike: Well, Adam meets 5 out of the 9 criteria that we agreed upon for this role. Sam meets 7 out of 9. She's objectively a more qualified candidate for this role.

FIFTH SCENE

Mike: In fact Sam's PhD was on second generation biofuels and some chapters of her thesis were published in important journals.

Willem: Mhh, I do want to see evidence that she has gotten these publications on her own.

Mike: As I was saying earlier, she developed this model for the degradation of sugars in acidic conditions that follows really well the experimental data. Adam has done a great work too but he has not come up with anything as close to Sam's solution to your challenge. Sam could brief you on her last findings, right?

-Mike looks at the camera/Sam; Sam however cannot say anything, as she is just the camera. However Willem starts talking right away, not leaving Sam time to answer, even if she could-

Willem: Also, if I remember correctly, Adam can count on strong network connections.

Mike: True, but when we committed on the hiring criteria before rating the applicants we agreed on giving more weight to internationally refereed publications and the proven ability to successfully acquire external funding for research projects. And that is what makes Sam a stronger candidate.

Willem: I see, however I believe that, if properly mentored, Adam could quickly be brought up to speed. Plus communications is just smoother among guys. Our research team is already composed of 6 male chemists... all big Formula 1 fans. I don't know how much Samantha would enjoy herself among the lads…

Mike: Willem, you know better than I do that you don't need to be a car-racing fan to be able to come up with a new fuel formula.

Willem: Also, I remember you saying that once Sam was offered the position she negotiated for a higher salary. Honestly, such strong negotiation style worries me. It seems rather "high maintenance".

Mike: Willem, didn't you negotiated for your own job too? Probably just like all the other researchers on your team. And surely you thought of it as a sign of self-confidence. I feel you are holding Sam to a different standard here.

SIXTH SCENE

Willem: I see. So, I suggest Sam joins us on a 3-month probation basis to see how we all get along. Perhaps you'll discover you like teaching better… Mike, in the meantime could you share Adam's details with me?

Mike: Will do.

Willem: Great, I think we can call it a meeting. I'm going to go for dinner. Feel like joining me? I'd like to hear your opinion about our latest bio refinery technology.

Mike: Sure.

Odessa: Thank you gentlemen. I'll send out a minute. It should take about half an hour. And thank you very much for your time Samantha. Bye

Mike: Bye

Willem: Bye

-They all walk towards the door. Sam remains seated.-

FADE TO BLACK

Appendix C.

VRIDS' Literature Grounding

When placed in the context of gender bias literacy interventions, the main aim of VRIDS is to increase participants' gender bias literacy. Consequently, the VRIDS's script was written to embed the four main gender bias mechanisms grounded in literature known to lead to stereotypic biases.

Firstly, for instance, a passage describing how some of Sam's thesis chapters were published in important journals, in response to which Willem asks for evidence that she has gotten these publications on her own, refers to the "**prove it again**" bias according to which women, as opposed to men, experience extra scrutiny of their accomplishments and which require women to provide more evidence than men to be perceived as qualified (Correll, 2017).

Secondly, a passage refers to the "**maternal wall**" bias based on which child-bearing age women are less likely to be hired while working mothers are judged as less committed and are consequently granted fewer chances for career progression (Hitting the Maternal Wall-Before They Reach a" Glass Ceiling" in Their Careers, Women Faculty May Hit a" Maternal Wall", n.d.).

Third, an instance in the script describing how Willem, having discovered that Sam is a female, disregards the previously agreed upon hiring criteria and shows a preference for Adam, the second best shortlisted candidate, is based on studies referring to the "**shifting criteria"** mechanism (Correll, 2017, p 6) according to which assessors attribute more weight to the criteria evidenced in men. In other words, when male applicants are unjustly preferred over female applicants, assessors justify their choices by redefining the criteria for success at the job (Uhlmann, & Cohen, 2005). To further push the second best candidate Willem also mentions how, if properly mentored, Adam could quickly be brought up to speed, even when evidence makes Sam a stronger candidate. This refers to how strong male support networks favour male over female candidates by encouraging them to apply, recommending them for positions and to committee members (Correll, 2017). Furthermore, script references to how Sam would struggle in a research team of Formula 1 fans refers to how, when a given group is considered lower in status and represents a distinct minority in a workplace, such as women in male-dominated workplaces, stereotypes about the lower status group are more notable, in turn leading to greater

biases in decision-making (Correll, 2017). Such dynamic is exacerbated when, for instance, artefacts and images in the environment are culturally associated with the dominant group such as geeky masculinity, Star Trek posters and video games (Cheryan, Plaut, Davies, & Steele, 2009).

Fourth, the instance in which Sam is judged as "high maintenance" for having negotiated for a higher salary, followed by Willem being reminded that the other researchers in the team did the same and which was considered as a sign of self-confidence, is grounded in literature supporting how stereotypes often lead to a "**double bind**" in which discernment of competence and likability (and consequent hireability) are negatively correlated for women, but not for men (Correll, 2017).

Appendix D.

Identity-safe Cue (PowerPoint Presentation Format)

Addressing women's underrepresentation in STEM

A module on recognizing and overcoming gender bias

1

Thank you for beginning this module, during which the following points will be covered:

1. HOW GENDER BIAS CAN HINDER ONE'S SUCCESS IN STEM
2. GENDER BIAS MANIFESTATIONS + EMPOWERING STRATEGIES
3. GENDER MAKES NO DIFFERENCE. STEREOTYPES DO.
4. WOMEN'S ABILITY TO THRIVE IN SPITE OF PREJUDICE
5. GOOD NEWS N°1: YOUR BELIEFS CAN HELP YOU
6. GOOD NEWS N°2: PERSONAL BIAS CAN BE OVERCOME

2

1. HOW GENDER BIAS CAN HINDER ONE'S SUCCESS IN STEM

Gender bias = prejudiced thoughts or actions originating from the gender-based perception that women are not equal to men in rights, dignity and capabilities.

Gender discrimination = the favorable treatment of men over women

which results in:

- obstacles to women's equal access and full participation to STEM professional opportunities and rewards (e.g., recruitment, promotion, pay)
- failed access to the overall pool of talented STEM professionals.

Source: Moss-Racusin et al., (2012); Pietri et al., (2019); Wang, & Degol, (2017).

3

Even *people who value being fair* may still perceive high power positions as masculine. This view is so pervasive in our society that it is hard to combat.

As a result, gender bias in the workplace may *not be intentional or conscious*. Rather, it often occurs on an automatic, unconscious, or *implicit* level.

Source: Nosek & Smyth (2011) *American Educational Research Journal*; *US Department of Commerce*

4

Even implicit, subtle bias can have important consequences and contributes to the underrepresentation of women in STEM:

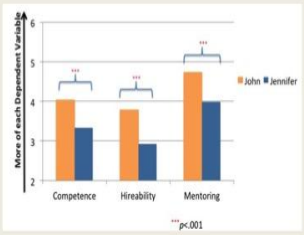
- Male professors are less likely to mentor female students.
- In science and engineering fields, while women earn 40% of doctorate degrees, they make up only 28% of full-time faculty.
- Biased evaluations can hold women back from obtaining higher positions in their jobs.

Source: Nosek & Smyth (2011) *American Educational Research Journal*; Sheltzer & Smith (2014) *Proceedings of the National Academy Sciences;* Steele, James, & Barnett (2002), *Psychology of Women's Quarterly*

5

- Reviewers were randomly assigned to rate a lab manager application that was either associated with the name "**John**" or "**Jennifer**".

- Even though the application was *identical*, both ***men and women*** reviewers rated the application higher when it was associated with the name "**John**" then "**Jennifer**".



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Source: Moss-Racusin et al. (2012) *Proceedings of the National Academy Sciences*

2. GENDER BIAS MANIFESTATIONS + EMPOWERING STRATEGIES

- Even if at times disheartening, bias awareness empowers you.
- Don't forget you are not alone. You can be part of a support network of women and men already striving for gender equality.

- Positive change towards gender equality in the workplace is already visible in policies and practices.

Gender bias has 3 manifestations:

1. Prove it Again!
2. The Double Bind
3. The Maternal Wall

7

1. Prove It Again!

In jobs historically held by men, men are presumed to be competent, while women often have to prove their competence over and over again.

Men are judged on their potential, while women are judged on what they have already accomplished.

8

Prove it again! Empowering strategies

- Build a network among the power players.

- Socialise your thesis/research/project beyond what you would normally feel comfortable doing. Make sure that people understand all the steps that went into it so that you can be evaluated on what you did rather than on a one-shot assumption about everything that went into it.

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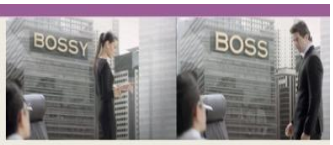
2. Double Bind



- Men are typically associated with agentic stereotypes (e.g. active, instrumental, competent).
- Women are typically associated with communal stereotypes (e.g. warm, nurturing, expressive).

When women act agentically, they are perceived as competent but not warm. But when they act warm, they are not thought of as competent.

They have to choose between being liked but not respected, or being respected but not liked. Either case threatens women's hiring opportunities.

Source: Rudman & Glick (2001) *Journal of Social Issues*

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Because of the double bind:

- Women receive "negative personality criticism", such as being called bossy or told to "watch their tone" in around 75% of performance reviews.
- Women receive 2.5 times the amount of feedback men do about aggressive communication styles, with phrases such as "your speaking style is off-putting."
- Self-promotion is seen as inappropriate in women ("she's a shameless self-promoter") but appropriate in men ("he knows his own worth").
- Workplace displays of anger raise the status of men but lower that of women.

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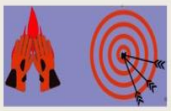
Double bind Empowering strategies

1. Simultaneously communicate competence and warmth

- Avoid qualifiers (just, maybe, I think, probably, very) and permissions (may I, sorry, excuse me) as they can negatively affect perceptions of competence by suggesting uncertainty or weakness.
- Appear strong without breaching stereotypes by adding warm opening and closing statements while keeping the substance of you message clear and direct (e.g., bookending emails with short friendly greetings).



12

2. Use a brief framing statement

Framing assertive statements with a "behaviour phrase," a "value phrase," or an "inoculation phrase" reduce the assertiveness backlash by 27%.

- "I'm going to express my opinion very directly; I'll be as specific as possible." (behaviour phrase)
- "I see this as a matter of honesty and integrity, so it's important for me to be clear about where I stand." (value phrase)
- "I know it's a risk for a woman to speak this assertively, but I'm going to express my opinion very directly." (inoculation phrase)

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3. Adopt dominant body language and direct speech but keep message communal

Use your body to take up space:

- Amy Cuddy's power pose
- stand tall
- drop an arm over the chair next to you
- putt an ankle across one knee
- lean back in a chair with your hands behind your head.

Establish dominance without initiating the backlash effect:

- speak in a loud voice
- maintain eye contact
- avoid hesitating while speaking.

4. Be succinct

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3. Maternal Wall

Women encountering bias after having children stems from stereotypes that link motherhood with lack of competence and commitment.

The leading study on maternal wall stereotypes found that, compared to women with identical resumes but no children, mothers are:

- 79% less likely to be hired
- Half as likely to be promoted
- Offered $11,000 less in salary for the same position
- Held to higher performance and punctuality standards.

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Maternal wall Empowering strategies

- After an absence due to having or adopting a child, refocus attention on your professional achievements and occupational role and away from the fact that you are a mother.
- When you are away at a conference etc., make sure that your colleagues are aware that that's why you are not around. People tend to interpret your absences and link it to lack of commitment.
- Be clear in what your goals are and in communicating how you are going to handle things in the context of your job. For example, if you want your career track to keep cranking at a high level and you know that travel is essential, communicate affirmatively that you are willing to travel.

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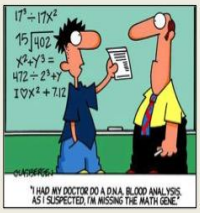
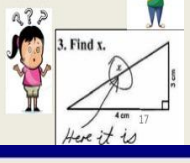
3. GENDER MAKES NO DIFFERENCE. STEREOTYPES DO.

The *math-gene*… is a myth. There is no evidence that women's biology makes them incapable of performing at the highest levels in any STEM field.



"Data show no meaningful differences in math performance among more than seven million boys and girls in grades 2 through 12 in the US".

Janet Hyde, Psychology professor at the University of Wisconsin–Madison



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4. WOMEN'S ABILITY TO THRIVE IN SPITE OF PREJUDICE

A cohort of women employed in science and technology were surveyed at the beginning of their first, second, third and fourth years in the companies. They report experiencing instances of gender bias throughout all four years. However, what is also evident is that gender bias is not stopping these women scientists from excelling and finding a community. They report that not only do they feel highly competent at their company but that they are close friends with both women and men co-workers.

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Cindy, a chemist, said:

"It has been uncomfortable at times. Throughout my career, I have felt like I have been disrespected because I'm a woman. I even had a co-worker subtly suggest I dressed too 'cute' to be a serious scientist. What does that even mean? When you encounter bias like that, it's easy to want to give up and pursue a different career. But I love what I do and I didn't want to just quit. I also realized that I couldn't fight every person who underestimates me. But I can band together with other women and men who care about fair and equal treatment. I've met a lot of people like this at my company. We've supported each other, worked well together, and worked to overcome gender bias."

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Similarly, Kelly, who works in technology, said:

"I have made wonderful friends at my company, both male and female. But, yeah, there are times when I feel I am treated unfairly because of my gender. It's terrible. It helps to talk with friends and colleagues I trust when I feel I've been disrespected. They sympathize/offer good advice. There at a lot of people out there both at my company and in the field generally who really understand that gender bias is an issue. I have to be honest, when I first started at my company, I felt pretty isolated. But over time I've found a really wonderful group of friends."

5. GOOD NEWS N°1: YOUR BELIEFS CAN HELP YOU

6. GOOD NEWS N°2: PERSONAL BIAS CAN BE OVERCOME

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As the target of prejudice, you can hold one of these two beliefs about prejudiced individuals and the malleability of their gender prejudice:

Fixed belief	Malleable belief
You do NOT believe that others can change = prejudice is fixed	You believe that others can change = prejudice is malleable
This makes you: -less motivated to confront prejudice -more likely to avoid people who express prejudice -anxious about being subjected to unchangeable prejudice.	This makes you: -more likely to confront explicit prejudice -less likely to avoid a person who made a biased statement on the basis of a single interaction.
Consequences: -failing to communicate antiprejudice norms -impact on psychological wellbeing -implications for social and professional interactions.	Benefits: -educating the speaker -leaving opportunities for professional or social interchange.

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Good news 1: You can change your beliefs about the malleability of others' prejudice.

If you are more of a "fixed-belief type", you can work on it by, for example:

- reading scientific evidence highlighting the malleability of prejudice
- learning about impressive exemplars of people who changed.

Believing that people's prejudiced views can change will help you to:

- confront their biased behaviours
- remain hopeful and stay where you are instead of disidentify yourself with STEM domains only because of the prejudice held by some people.

Good news 2: click ➔

Source: Rattan, A., & Dweck, C. S. (2010). Who confronts prejudice? The role of implicit theories in the motivation to confront prejudice.

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Good news 2: Prejudiced people can change and overcome their bias **if they are motivated and willing**.

Researchers have studied people who are **internally motivated** *(motivation that comes from personal values)* to control their bias against various groups.

For example, people high in internal motivation to control prejudice towards Black individuals will agree with statements such as:

- *"I am personally motivated by my beliefs to be non-prejudiced toward Black people."*
- *"Because of my personal values, I believe that using stereotypes about Black people is wrong."*

Source: Plant & Devine (1998) *Journal of Personality and Social Psychology*

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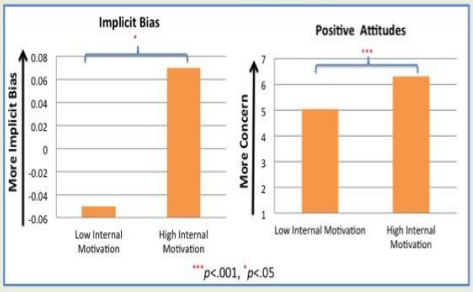
Individuals who are high (versus low) in internal motivation to control their prejudice have more positive reported attitudes towards Black people and lower implicit bias against Black people.



Similarly, individuals who are internally motivated to control their gender bias are more likely to criticize sexist jokes.

Sources: Devine et al. (2002) *Journal of Personality and Social Psychology;* Klonis et al. (2005*) Personality and Social Psychology Bulletin*

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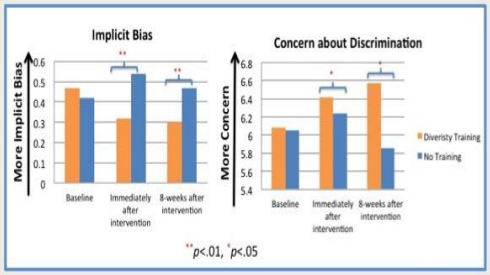
Individuals who are internally motivated to control their prejudice are also more likely to spend time actively engaging in trainings that reduce bias.

Of importance, diversity trainings and workshops can be effective at reducing biases.

Sources: Plant & Devine (2009) *Journal of Personality and Social Psychology*

For example, after undergoing a prejudice reduction training, participants showed reduced automatic or implicit bias, and increased concern about discrimination.



In another study, a workshop on gender bias resulted in a better working climate.

Sources: Carnes et al. (2014) *Academic Medicine;* Devine et al. (2012*) Journal of Experimental Social Psychology*

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If one is motivated, personal gender bias can be overcome.

The great news is: As leader or employee of your organization you are in a position to combat gender bias in the sciences and to create a more welcoming environment for women.

In fact, many people have been successful in combating gender bias in the workplace.

Click ➔ for a success story.

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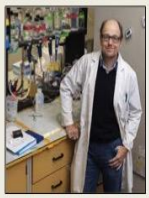

Dr. Derek Michaels,
Professor in Biology

"When I first started teaching, gender bias was not something I gave much thought to. Then I went to a gender bias workshop and saw all the ways bias could infiltrate my teaching and interactions with students. It was frankly overwhelming. I didn't realize that I was only including pictures of male scientists in my lectures. I never had students work in groups, and I tended to focus my attention on the most vocal students (who were, surprise, mostly men). These were all things I could actually change to create a more inclusive classroom."

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"Why doesn't constant trampling defeat the dandelion? The key to its strength is its long and sturdy root, which extends deep into the earth. The same principle applies to people. The true victors in life are those who, enduring repeated challenges and setbacks, have sent the roots of their being to such a depth that nothing can shake them."

Daisaku Ikeda

Thank you very much for taking the time to participate in this study.

Your input is extremely valued.

Appendix E.

Questionnaire

What are you doing at the moment? Write down your answer in the text box below. 1. Bachelor 2. Master 3. PhD 4. Other (please specify in writing)					
What is your domain (e.g., computer science, advanced technology, mechanical engineering, applied mathematics)? Write down the full name.					
Rate your level of agreement from 1 (not at all) to 5 (extremely) with each of the following items.					
	Not at all-	Slightly-	Moderately-	Very-	Extremely
In my opinion, women in STEM often do not face discrimination based on their gender [R]	1	2	3	4	5
In my opinion, women in STEM often are not taken as seriously as their male colleagues	1	2	3	4	5
In my opinion, women in STEM often don't have to work harder than their male colleagues to show they are equally as competent as the men [R]	1	2	3	4	5

In my opinion, women in STEM often face negative reactions for being aggressive	1	2	3	4	5
In my opinion, women in STEM often face negative reactions for being assertive	1	2	3	4	5
In my opinion, women in STEM often face negative reactions for being ambitious	1	2	3	4	5
In my opinion, women in STEM often have trouble getting hired if they are pregnant	1	2	3	4	5
In my opinion, people who work in STEM often do not want to hire women because they worry that the women might become pregnant and be unable to do their job adequately [R]	1	2	3	4	5
Imagine that, just like Sam, you work as a STEM researcher at a Dutch technical university. **Now answer some questions related to your feelings about this workplace.** **Rate your level of agreement from 1 (strongly disagree) to 5 (strongly agree) with each of the following items.**					
Colleagues at this University would like me	1	2	3	4	5
Colleagues at this University would be a lot like me	1	2	3	4	5
I would belong at this university	1	2	3	4	5
At this university I would feel like an outsider [R]	1	2	3	4	5
At this university I would feel respected	1	2	3	4	5

At this university I would feel excluded [R]	1	2	3	4	5
At this university I would enjoy being an active participant	1	2	3	4	5
I think I would like to work at a place like this university	1	2	3	4	5
I think I could 'be myself' at this university	1	2	3	4	5
I think would be treated fairly by colleagues at this university	1	2	3	4	5
I think my values and the values at this university are very similar	1	2	3	4	5
Imagine that, just like Sam, you work as a STEM researcher at a Dutch technical university. **Now answer some questions related to your feelings about this workplace.** **Rate your level of agreement from 1 (strongly disagree) to 5 (strongly agree) with each of the following items.**					
At this university I would worry that people would draw conclusions about my ability based on the performance of other people who are the same gender as me.	1	2	3	4	5
At this university people will draw conclusions about my whole gender group based on my performance.	1	2	3	4	5
Answer some questions related to how much you feel these emotions when thinking about combating gender bias in STEM. **Rate your level of agreement from 1 (not at all) to 5 (extremely) with each of the following items.**					

Threatened	1	2	3	4	5
Anxious	1	2	3	4	5
Worried	1	2	3	4	5
Pessimistic	1	2	3	4	5
Discouraged	1	2	3	4	5
Blue	1	2	3	4	5
Happy [R]	1	2	3	4	5
Desperate	1	2	3	4	5
Hopeless	1	2	3	4	5
Now answer some questions related to how you feel about the reduction of gender bias against women in STEM. **Rate your level of agreement from 1 (strongly disagree) to 5 (strongly agree) with each of the following items.**					
People have a certain amount of gender bias and they really can't do much to change it.	1	2	3	4	5
A person's gender bias is something very basic about them and it can't be changed very much.	1	2	3	4	5
There is not much that can be done to change a person's gender bias.	1	2	3	4	5
Now answer some questions related to how you feel about tackling gender bias in STEM. **Rate your level of agreement from 1 (strongly disagree) to 5 (strongly agree) with each of the following items.**					

I believe that I, as an individual, can reduce gender bias in STEM.	1	2	3	4	5
I believe that I can reduce gender bias in STEM.	1	2	3	4	5
I believe that I, through individual actions, can reduce gender bias in STEM.	1	2	3	4	5
I believe that I can achieve my personal goal of reducing gender bias in STEM.	1	2	3	4	5

Appendix F.

Semi-structured Interview Questions

Did you respond differently to the second VR viewing after going through the PPP? How? If not, what where those thoughts that were the same?	Measuring PPP (aka ISC) general learning effectiveness, a way to see if the treatment is effective (e.g., Does the effect of VRIDS change over time/after the treatment?)
How did the PPP make you interpret the characters' circumstances differently?	
While watching the VR the second time, have you applied some of the learning you got from the PPP? If so, please elaborate.	
Can you think of an occasion in your daily life you would apply what you learnt in the PPP?	Measuring self-efficacy & predicted behavioural change, which is learning
After watching the VR the 1st time, how much would you like to work in STEM domains on a scale from 1 to 10?	Measuring Trust and Belonging and predicted perseverance in STEM domains?
After the PPP, how much would you like to work in STEM domains on a scale from 1 to 10?	
While in the VR did you feel fully engaged with the events taking place or where you thinking about what was going on outside the VR, so in the room, outside etc.?	VR PROPERTIES Measuring sense of immersion
While in the VR, did you have the perception of being physically present in that non-physical world?	VR PROPERTIES Measuring sense of presence
While being immersed in the VR could you feel the emotions in Sam's head?	VR PROPERTIES Measuring identification
While being immersed in the VR did you feel like Sam's body was your body?	VR PROPERTIES Measuring body ownership

Appendix G.

Factor Analysis

Table 7

Factor Analysis' Results of the Six Factors.

		Initial Eigenvalues		*Rotation Sums of Squared Loadings*		
Factor	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	12.831	34.678	34.678	7.992	21.599	21.599
2	4.599	12.430	47.108	5.772	15.600	37.199
3	3.376	9.125	56.233	4.366	11.800	48.998
4	2.771	7.489	63.722	3.417	9.235	58.233
5	2.057	5.559	69.281	2.569	6.942	65.175
6	1.518	4.102	73.383	1.299	3.512	68.687

Table 8

Factor Loadings of the Six Dependent Variables.

	Factor					
Variable	*1*	*2*	*3*	*4*	*5*	*6*
Awareness of gender bias_1r	.104	**.633**	.064	-.083	-.124	.514
Awareness of gender bias_2	-.321	**.763**	.102	.019	-.058	-.002
Awareness of gender bias_3r	-.060	**.406**	.101	.082	-.024	.345
Awareness of gender bias_4	-.263	**.813**	-.074	.085	-.165	.116
Awareness of gender bias_5	-.224	**.854**	-.115	.214	.001	.117
Awareness of gender bias_6	-.192	**.786**	.040	.189	-.009	.020
Awareness of gender bias_7	.008	**.667**	.259	-.024	.246	.057
Awareness of gender bias_8r	.165	**-.660**	-.258	.007	-.164	.173
Belonging and trust_1	**.783**	-.061	-.029	-.074	.180	.023
Belonging and trust_2	**.605**	-.105	-.114	.118	.049	-.058
Belonging and trust_3	**.811**	-.195	-.207	.088	-.121	.012
Belonging and trust_4r	**.594**	-.202	-.137	-.031	-.002	-.546
Belonging and trust_5	**.800**	-.160	-.298	-.007	-.046	-.058
Belonging and trust_6r	**.805**	-.211	-.251	-.057	.015	-.313
Belonging and trust_7	**.825**	-.125	-.343	.072	.031	.026
Belonging and trust_8	**.749**	-.213	-.216	.095	.020	.070
Belonging and trust_9	**.810**	-.262	-.253	.122	.175	-.023
Belonging and trust_10	**.737**	-.347	-.267	-.038	.072	-.126
Belonging and trust_11	**.770**	-.278	-.110	.165	-.068	.043
Stereotype threat concerns_1	-.330	**.605**	.034	-.031	-.207	-.069
Stereotype threat concerns_2	-.246	**.525**	.105	.072	-.035	.071
General negative affect_1	-.195	**.377**	.294	-.047	-.334	-.146
General negative affect_2	-.302	.323	**.553**	-.016	-.451	-.033
General negative affect_3	-.458	.435	**.586**	-.099	-.134	-.128
General negative affect_4	-.284	.108	**.711**	.061	.144	.127

General negative affect_5	-.353	.119	**.789**	-.052	-.025	.218
General negative affect_6	-.497	.228	**.623**	.128	.001	-.048
General negative affect_7r	-.366	.059	.166	-.301	-.091	**.356**
General negative affect_8	-.178	-.034	**.880**	.081	-.006	.103
General negative affect_9	-.461	.019	**.715**	.165	.215	-.117
Growth mindset_1	.072	-.197	.167	-.285	**.560**	.213
Growth mindset_2	-.043	-.002	.034	.027	**.949**	-.300
Growth mindset_3	.054	.109	.005	-.259	**.798**	.001
Self-efficacy beliefs_1	.106	.038	-.041	**.850**	-.143	.058
Self-efficacy beliefs_2	.136	.115	.051	**.855**	-.095	.013
Self-efficacy beliefs_3	.023	.067	.018	**.868**	-.089	-.075
Self-efficacy beliefs_4	.026	.120	.193	**.839**	-	-.002