**Supplemental Material**

1. **Manipulation**

**Social identity threat manipulation in German**

**Studie zu sozialen Beziehungen und Leistung**

1. **Ziel der Studie und das Vorgehen**

Das Ziel dieser Studie ist es zu untersuchen, wie sich der Kontakt zu anderen Studentinnen und Studenten darauf auswirkt, wie Frauen in mathematischen Tests abschneiden. Dafür werden wir Sie bitten, zuerst einen Test durchzuführen. Danach werden wir Ihnen Fragen zur Quantität und Qualität Ihres Kontaktes mit anderen Studentinnen und Studenten stellen.

1. **Wichtige Hintergrundinformationen zur Studie**

In mathematischen Studienfächern sind nur wenige Frauen zu finden und auf dem Weg zu den Spitzenpositionen (z.B. in der Wissenschaft) geht die **Frauenquote fast gegen Null**. Die wichtigsten Preise in Mathematik, wie z.B. die Fields-Medaille, wurden bisher erst einmal an eine Frau vergeben. Dem statistischen Bundesamt zu Folge, sind zu Studienbeginn in technisch-mathematischen Fächern (wie z.B. Maschinenbau, Informatik) nur 20% der Studierenden weiblich, was im Laufe des Studiums zudem stark abnimmt. Zur Erklärung dieser Situation werden immer wieder Studien herangezogen, die berichten, dass **Männer in standardisierten Mathematiktests höhere Werte erreichen als Frauen**.

Im Folgenden bitten wir Sie einen dieser Tests durchzuführen. Zunächst werden Sie eine Beispielaufgabe aus dem folgenden Test sehen. Bitte lesen Sie die Testinstruktionen sorgfältig durch!

**Social identity threat manipulation in English**

**Study on social relationships and performance**

1. **Goal of the study and procedure**

The goal of the study is to investigate how contact with female and male students affects women’s performance in mathematical tests. For this reason, we will ask you to work on a test. Afterwards, you will answer questions about the quality and quantity of your contact with other female and male students.

1. **Important background information about the study**

Very few women are enrolled in mathematical subjects at university, and when looking at top positions (e.g., in science) the **proportion of women is approaching zero**. The most important award in mathematics, the Fields Medal, has only been awarded once to a woman. According to the Federal Statistical Office, only twenty percent of first-year university students in mathematical subjects (such as mechanical engineering and computer science) are female and many of them drop out during their studies. One potential explanation for this situation is provided by studies reporting that **men achieve higher outcomes on standardized mathematical tests than women**.

In the following, we ask you to complete one of these tests. Next, you will see an example problem. Please read the test instructions carefully.

**B) Scales in German and English translation**

**Measure of social approach and avoidance motivation**

Table 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Item | English Translation | Subscale | Reference |  | Used in analyses of study: |  |  |
| Ich finde es spannend, mit anderen Studentinnen ganz verschiedene Themen zu diskutieren[[1]](#footnote-1). | I find it exciting to discuss with female students on numerous topics. | Approach | Lavigne, Vallerand, & Crevier-Braud, 2011 |  | Study 1a,1b,2,3 |  |  |
| Ich brauche es, mich von anderen Studentinnen akzeptiert zu fühlen. | I need to feel accepted by other female students. | Avoidance | Lavigne et al., 2011 |  | Study  1a,1b,2,3 |  |  |
| Ich suche den Kontakt zu anderen Studentinnen, um nicht allein zu sein. | I approach other female students because I don’t want to be alone. | Avoidance | Lavigne et al., 2011 |  | Study  1a,1b,2,3 |  |  |
| Kontakt mit anderen Studentinnen erlaubt es mir, viel von Menschen zu entdecken. | Interactions with other female students allow me to discover a lot about others. | Approach | Lavigne et al., 2011 |  | Study 1a,1b,2,3 |  |  |
| Ich versuche, viele lustige und sinnvolle Erfahrungen mit anderen Studentinnen zu teilen. | I try to share many fun and meaningful experiences with other female students. | Approach | Elliot, Gable, & Mapes, 2006 |  | Study 1a,1b,2,3 |  |  |
| Ich versuche, Meinungsverschiedenheiten und Konflikte mit anderen Studentinnen zu vermeiden. | I try to avoid disagreements and conflicts with other female students. | Avoidance | Elliot et al., 2006 |  | Study 1a,1b,2,3 |  |  |
| Ich hätte gerne mehr Kontakt zu anderen Studentinnen. | I would like to have more contact with other female students. | Exploratory  (excluded) | Newly-generated |  | Excluded from all studies |  |  |
| Ich will von anderen Studentinnen nicht zurückgewiesen werden. | I don’t want to be rejected by other female students. | Avoidance | Newly-generated |  | Study 1a,1b,2,3 |  |  |
| Ich habe viel Kontakt mit anderen Studentinnen. | I have a lot of contact with other female students. | Approach | Newly-generated |  | Study 1a,1b,2,3 |  |  |
| Ich habe gerne Kontakt mit anderen Studentinnen. | I like having contact with other female students. | Approach  (excluded) | Newly-generated |  | Excluded from all studies |  |  |
| Ich möchte anderen Studierenden etwas Gutes tun oder nett zu ihnen sein. | I would like to do good things for other students and to be nice to them. | Approach goal | Nikitin & Freund, 2017 |  | Study 1b |  |  |
| Ich möchte mit anderen Studierenden eine tolle Zeit verbringen. | I would like to have a good time with other students. | Approach goal | Nikitin & Freund, 2017 |  | Study 1b |  |  |
| Ich möchte mit anderen Studierenden Kontakte knüpfen. | I would like to socialize with other students. | Approach goal | Nikitin & Freund, 2017 |  | Study 1b |  |  |
| Ich möchte Konflikte mit anderen Studierenden vermeiden. | I would like to avoid conflicts with other students. | Avoidance goal | Nikitin & Freund, 2017 |  | Study 1b |  |  |
| Ich möchte andere Studierende nicht verletzen. | I don’t want to hurt other students. | Avoidance goal | Nikitin & Freund, 2017 |  | Study 1b |  |  |
| Ich möchte von anderen Studierenden nicht verletzt werden. | I don’t want to get hurt by other students. | Avoidance goal | Nikitin & Freund, 2017 |  | Study 1b |  |  |

**Measure of sense of belonging**

Table 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Item | English Translation | Subscale | Reference |  |  | Used in the analyses of study |  |
| Ich fühle mich an der Universität zugehörig. | I feel like I belong at university. | Membership | Good, Rattan, & Dweck, 2012 |  |  | Study 1b,2,3 |  |
| Ich fühle mich als Mitglied der Studentenschaft. | I feel like a member of the group of university students. | Membership | Good et al., 2012 |  |  | Study 1b,2 |  |
| Ich fühle mich mit anderen Studierenden verbunden. | I feel connected to other university students. | Membership | Good et al., 2012 |  |  | Study 1b,2,3 |  |
| Ich fühle mich als Teil der Studentenschaft. | I feel like I am a part of the university. | Membership | Good et al., 2012 |  |  | Study 1b,2 |  |
| An der Universität fühle ich mich akzeptiert. | At university, I feel accepted. | Acceptance | Good et al., 2012 |  |  | Study 1b,2,3 |  |
| An der Universität fühle ich mich respektiert. | At university, I feel respected. | Acceptance | Good et al., 2012 |  |  | Study 1b,2,3 |  |
| An der Universität fühle ich mich geschätzt. | At university, I feel valued. | Acceptance | Good et al., 2012 |  |  | Study 1b,2,3 |  |
| An der Universität fühle ich mich willkommen. | At university, I feel appreciated. | Acceptance | Good et al., 2012 |  |  | Study 1b,2,3 |  |

**Measure of experienced social identity threat**

Table 3

|  |  |  |  |
| --- | --- | --- | --- |
| Item | English Translation | Reference | Used in the analyses of study |
| Haben Sie Bedenken, dass Sie die Vorurteile[[2]](#footnote-2) über Mathematikfähigkeiten von Frauen in Statistikkursen bestätigen könnten? | Are you concerned that you will confirm stereotypes about women’s math abilities in statistics? | Adopted from Shapiro, 2011 | Study 3 |
| Haben Sie Bedenken, dass die Vorurteile über Mathematikfähigkeiten von Frauen Ihre eigenen Statistikleistungen einschränken könnten? | Are you concerned that stereotypes about women’s abilities in math might hinder your performance in statistics? | Adopted from Shapiro, 2011 | Study 3 |
| Haben Sie Bedenken, dass die Vorurteile über Mathematik- und Statistikfähigkeiten von Frauen wahr sind? | Are you concerned that the stereotypes about women’s math and statistics abilities are true? | Adopted from Shapiro, 2011 | Study 3 |
| Haben Sie Bedenken, dass die Vorurteile über Mathematikfähigkeiten von Frauen Andere in der Beurteilung Ihrer Statistikleistungen beeinflussen könnten? | Are you concerned that the stereotypes about women’s math abilities might influence how others judge your performance in statistics? | Adopted from Shapiro, 2011 | Study 3 |
|  |  |  |  | |

**C) Additional Analyses**

**Results: Test Performance**

**Study 1a**

We tested the effect of condition (social identity threat = 1 vs. control = -1) on math performance using an ANCOVA. In order to control for previous performance, we included the final math grade in high school as covariate (z-standardized). Results showed no significant effect of condition, *F*(1,74) = 1.63, *p* = .21, or of the covariate, *F*(1,74) = 0.33, *p* = .57 (social identity threat condition: *M* = 3.43, *SE* = 0.40; control condition: *M* = 2.71, *SE* = 0.40; all means adjusted for the covariate).

**Study 1b**

We tested the effect of condition (social identity threat = 1; control = -1) and gender on math performance using an ANCOVA controlling for previous performance in math by including the final math grade in high school as covariate (z-standardized). Results showed a significant effect of final math grade, *F*(1,152) = 6.06, *p* = .02, *d* = 0.40. No further main effects were significant, all *p*s *>* .07. The interaction between gender and condition was also not significant, *p* = .96 (social identity threat condition:women: *M* = 4.67, *SE* = 0.40, men: *M* = 5.38, *SE* = 0.41; control condition: women: *M* = 4.39, *SE* = 0.41, men: *M* = 5.14, SE = 0.38; all means adjusted for the covariate).

**Study 2**

We tested the effect of condition (social identity threat = 1 vs. control = -1) on math performance using an ANCOVA controlling for previous performance in math by including the final math grade in high school as covariate (z-standardized). Results showed a non-significant trend, *F*(1,96) = 2.49, *p* = .12, *d*  = 0.35. The covariate was not significant, *F*(1,96) = 1.63, *p* = .21. The activation of a negative performance-related stereotype tended to decrease subsequent performance after stereotype activation (*M* = 4.02, *SE* = 0.31) compared to the control condition (*M* = 4.72, *SE* = 0.31; all means adjusted for the covariate).

**Results: Social Avoidance Motivation**

In the present work, our predictions focus on the consequences of stereotype threat for the social approach motivation of female university students. However, there is a long research tradition showing that social avoidance motivation (i.e., the motivation to avoid negative social outcomes such as rejection, conflict, and isolation; Gable & Berkman, 2008; Mehrabian, 1994) is also an important component of social motivation. For young people, social approach motivation is of greater importance than social avoidance motivation (Nikitin, Schoch, & Freund, 2014). This is the case because developmental tasks in young adulthood involve building new social ties (such as establishing a social network, finding a partner, etc.), which requires social approach (but not avoidance) motivation (Gable & Berkman, 2008; Nikitin & Freund, 2008). In line with this argumentation, Nikitin and colleagues (2014) demonstrated that not only do young adults report higher levels of social approach (compared to avoidance) motivation, but that social approach motivation predicts young adults’ experience of social interactions more strongly than social avoidance motivation. Thus, we assume that young adults’ social approach (compared to avoidance) motivation is more sensitive to signals indicating a lack of social integration (as might be the case after the activation of negative stereotypes) because this threatens their ability to accomplish important developmental tasks in young adulthood (e.g., building new social ties).

**Study 1a**

We also tested whether the effect of social approach motivation differed from the effect on social avoidance motivation (α = .82) using a repeated measures ANOVA with motivation (approach vs. avoidance) as within factor and condition (social identity threat vs. control) as between factor, controlling for order. The predicted two-way interaction between motivation (approach vs. avoidance) and condition (social identity threat vs. control) was significant, *F*(1,76) = 4.23, *p* = .04, *d* = .47. T-tests for independent samples showed that whereas participants reported significantly lower levels of social approach motivation in the social identity threat condition (*M* = 5.41, *SE* = 0.13) than in the control condition (*M* = 5.77, *SE* = 0.11), *t*(77) = -2.09, *p* = .04, *d* = 0.47; this was not the case for social avoidance motivation (social identity threat condition: *M* = 5.23, *SE* = 0.15; control condition: *M* = 5.10, *SE* = 0.17), *t*(77) = 0.60, *p* = .55.

**Study 1b**

We tested whether the effect of social approach motivation differed from the effect on social avoidance motivation (α = .86) using a repeated measures ANOVA with motivation (approach vs. avoidance) as within factor and condition (social identity threat vs. control) and gender (women vs. men) as between factors. The only significant effect was an interaction between motivation and gender, *F*(160) = 7.15, *p* = .01. Even though the two-way interaction between motivation (approach vs. avoidance) and condition (social identity threat vs. control) and the three-way interaction between motivation, condition, and gender were not significant (*p*s > .80), independent sample t-tests showed that whereas women’s social approach motivation was reduced in the social identity threat condition (*M* = 5.28; *SE* = 0.13) compared to the control condition (*M* = 5.67, *SE* = 0.11), *t*(78) = 2.22, *p* = .03, this was not the case for their social avoidance motivation (social identity threat condition: *M* = 4.60; *SE* = 0.18; control condition: *M* = 4.93, *SE* = 0.15), *t*(78) = -1.42, *p* = .16.

**Study 2**

We tested whether the effect of social approach motivation differed from the effect on social avoidance motivation (α = .80) following the procedure of Study 1a. The predicted two-way interaction between motivation (approach vs. avoidance) and condition (social identity threat vs. control) was significant, *F*(1,98) = 5.28, *p* = .02, *d* = 0.46. T-tests for independent samples showed that, as predicted, participants reported significantly lower levels of social approach motivation in the social identity threat condition (*M* = 5.43, *SE* = 0.12) than in the control condition (*M* = 5.83, *SE* = 0.10; *F*(1,98) = 6.49, *p* = .012, *d* = 0.50); this was not the case for social avoidance motivation (social identity threat condition: *M* = 4.62; *SE* = 0.16; control condition: *M* = 4.53, *SE* = 0.12), *t*(98) = -0.47, *p* = .64.

**Study 3**

We also tested the mediation model for social avoidance motivation as dependent variable. To do so, we used experienced social identity threat in statistic classes as predictor, the sense of belonging to university as mediator, and social avoidance motivation towards other university students as the outcome. Again, we used Hayes Model 4 (2013; 50,000 bootstraps) to test the mediational model. The total effect was not significant (*p* = .11). The effect of experienced social identity threat on sense of belonging was significant (*a* = -0.15, *SE* = 0.07, *t* = -2.16, *p* = .03, 95% CI [-0.29, -0.01]). However, sense of belonging did not significantly predict social avoidance motivation (*p* = .43). The indirect effect was also not significant (*ab* = 0.01, *SE* = 0.02, 95% CI [-0.01, 0.06]).

**References**

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1. All items were repeated using the German male term for students (“Studenten”). [↑](#footnote-ref-1)
2. The German word „Vorurteile“ would directly translate to the English word „prejudice“. However, as in daily life in Germany this term is used to refer to stereotypes as well as to prejudice and the German term “Stereotype” is not well-known and commonly used, we decided to use this term in the items. [↑](#footnote-ref-2)