

Mangels et al. (2012)

If the study has a broad focus and this data extraction focuses on just one component of the study, please specify this here

☒ Not applicable (whole study is focus of data extraction)

Study aim(s) and rationale

Was the study informed by, or linked to, an existing body of empirical and/or theoretical research?

☒ Explicitly stated (please specify)

The study was informed by research on stereotype threat and its effects on performance, as well as theories about how emotional processing interferes with cognitive processing under stereotype threat. The authors cite multiple previous studies on these topics.

Do authors report how the study was funded?

☒ Explicitly stated (please specify)

The study was funded by the Institute for Educational Sciences (IES) Cognition and Student Learning (CASL) Grant.

Study research question(s) and its policy or practice focus

What is/are the topic focus/foci of the study?

The study focuses on stereotype threat effects on females' math performance and learning, specifically examining how emotional responses to negative feedback impact learning under stereotype threat conditions.

What is/are the population focus/foci of the study?

The population focus is female undergraduate students.

What is the relevant age group?

☒ 17 - 20

☒ 21 and over

The mean age of participants was around 20 years old across groups.

What is the sex of the population focus/foci?

☒ Female only

What is/are the educational setting(s) of the study?

☒ Higher education institution

The study was conducted with undergraduate students at Columbia University.

In Which country or countries was the study carried out?

☒ Explicitly stated (please specify)

The study was carried out in the United States, at Columbia University in New York.

Please describe in more detail the specific phenomena, factors, services, or interventions with which the study is concerned

The study examines how stereotype threat affects females' emotional responses to negative feedback on a math test, and how these emotional responses impact subsequent learning from tutorial information and performance on a retest. It uses ERP measures to assess emotional processing of feedback.

What are the study research questions and/or hypotheses?

☒ Explicitly stated (please specify)

The main research questions are: 1) How does stereotype threat influence females' emotional responses to negative feedback? 2) Do these emotional responses predict: (i) use of tutorial information (engagement with learning) and (ii) ability to correct errors on a retest (success in learning)?

Methods - Design***Which variables or concepts, if any, does the study aim to measure or examine?***

☒ Explicitly stated (please specify)

Key variables measured include: - Math performance (first test and retest accuracy) - ERP responses to feedback (FRN, P3a, LPP) - Tutorial use (engagement and depth of exploration) - Learning success (error correction on retest)

Study timing

☒ Prospective

The study took place over three days, with initial measures, the math test and ERP recording on day 2, and a surprise retest on day 3.

If the study is an evaluation, when were measurements of the variable(s) used for outcome made, in relation to the intervention?

- ☒ Before and after

Math performance was measured before (first test) and after (retest) the stereotype threat manipulation and tutorial intervention.

Methods - Groups

If comparisons are being made between two or more groups, please specify the basis of any divisions made for making these comparisons.

- ☒ Prospective allocation into more than one group (e.g. allocation to different interventions, or allocation to intervention and control groups)

Participants were allocated to either a stereotype threat or non-threat condition.

How do the groups differ?

- ☒ Explicitly stated (please specify)

The groups differed in the instructions given before the math test. The stereotype threat group received instructions emphasizing evaluation of math ability and gender comparisons, while the non-threat group received instructions minimizing these aspects.

Number of groups

- ☒ Two

Stereotype threat and non-threat groups.

Was the assignment of participants to interventions randomised?

- ☒ Not stated/unclear (please specify)

The paper does not explicitly state whether assignment to conditions was randomized.

Where there was prospective allocation to more than one group, was the allocation sequence concealed from participants and those enrolling them until after enrolment?

- ☒ Not stated/unclear (please specify)

The paper does not provide information on allocation concealment.

Apart from the experimental intervention, did each study group receive the same level of care (that is, were they treated equally)?

- ☒ Yes

Both groups completed the same math test, received the same feedback, and had access to the same tutorial information.

Study design summary

This was a prospective experimental study comparing two groups: females under stereotype threat or non-threat conditions. Participants completed a challenging math test while EEG was recorded, received accuracy feedback after each problem, and had access to tutorial information. A surprise retest was given 24 hours later. The study examined how stereotype threat affected emotional responses to feedback (measured via ERPs) and how these responses related to tutorial use and learning success.

Methods - Sampling strategy

Are the authors trying to produce findings that are representative of a given population?

☒ Implicit (please specify)

While not explicitly stated, the authors appear to be aiming for findings representative of female undergraduate students in math-related contexts.

Which methods does the study use to identify people or groups of people to sample from and what is the sampling frame?

☒ Not stated/unclear (please specify)

The paper does not provide details on the sampling frame or recruitment methods.

Which methods does the study use to select people or groups of people (from the sampling frame)?

☒ Not stated/unclear (please specify)

The paper does not provide details on participant selection methods.

Planned sample size

☒ Explicitly stated (please specify)

The planned sample size was 71 participants.

Methods - Recruitment and consent

Which methods are used to recruit people into the study?

☒ Not stated/unclear (please specify)

The paper does not provide details on recruitment methods.

Were any incentives provided to recruit people into the study?

☒ Not stated/unclear (please specify)

The paper does not mention whether incentives were provided.

Was consent sought?

☒ Not stated/unclear (please specify)

The paper mentions that participants were “consenting” but does not provide details on the consent process.

Are there any other details relevant to recruitment and consent?

☒ No

Methods - Actual sample***What was the total number of participants in the study (the actual sample)?***

☒ Explicitly stated (please specify)

The final sample included 68 participants (32 in stereotype threat, 36 in non-threat).

What is the proportion of those selected for the study who actually participated in the study?

☒ Not stated/unclear (please specify)

The paper does not provide information on the proportion of selected participants who completed the study.

Which country/countries are the individuals in the actual sample from?

☒ Explicitly stated (please specify)

Participants were undergraduate students at Columbia University in the United States.

What ages are covered by the actual sample?

☒ 17 to 20

☒ 21 and over

The mean age across groups was around 20 years old.

What is the socio-economic status of the individuals within the actual sample?

☒ Not stated/unclear (please specify)

The paper does not provide information on participants’ socio-economic status.

What is the ethnicity of the individuals within the actual sample?

☒ Explicitly stated (please specify)

The sample included both Caucasians (N = 61) and non-Caucasians (N = 10). Asians were excluded.

What is known about the special educational needs of individuals within the actual sample?

☒ Explicitly stated (please specify)

The paper states that participants were neurologically healthy.

Is there any other useful information about the study participants?

☒ Explicitly stated (please specify no/s.)

Participants were all English-speaking and right-handed.

How representative was the achieved sample (as recruited at the start of the study) in relation to the aims of the sampling frame?

☒ Unclear (please specify)

Without more information on the sampling frame and recruitment methods, it's unclear how representative the sample was.

If the study involves studying samples prospectively over time, what proportion of the sample dropped out over the course of the study?

☒ Explicitly stated (please specify)

4 participants were excluded: 1 who never used the tutor and 3 with EEG recording difficulties.

For studies that involve following samples prospectively over time, do the authors provide any information on whether and/or how those who dropped out of the study differ from those who remained in the study?

☒ No

If the study involves following samples prospectively over time, do authors provide baseline values of key variables such as those being used as outcomes and relevant socio-demographic variables?

☒ Yes (please specify)

The authors provide baseline measures of math SAT scores, math and gender identification, and perception of environmental stereotype threat.

Methods - Data collection

Please describe the main types of data collected and specify if they were used (a) to define the sample; (b) to measure aspects of the sample as findings of the study?

☒ Details

Data collected included: a) To define the sample: math SAT scores, math and gender identification b) As findings: math test performance, ERP responses to feedback, tutorial use, retest performance

Which methods were used to collect the data?

- ☒ Self-completion questionnaire
- ☒ Exams
- ☒ Clinical test
- ☒ Psychological test

Details of data collection methods or tool(s).

- ☒ Explicitly stated (please specify)

The study used questionnaires for pre-measures, a GRE-like math test, EEG recording during the test, an interactive math tutor, and a surprise retest.

Who collected the data?

- ☒ Researcher

Do the authors describe any ways they addressed the reliability of their data collection tools/methods?

- ☒ Details

The authors mention using multiple goodness-of-fit indices for their structural equation modeling analysis.

Do the authors describe any ways they have addressed the validity of their data collection tools/methods?

- ☒ Details

The authors cite previous research supporting the use of their ERP measures (FRN, P3a, LPP) as indices of emotional processing.

Was there concealment of study allocation or other key factors from those carrying out measurement of outcome – if relevant?

- ☒ No (please specify)

The researchers were aware of participants' group allocation.

Where were the data collected?

- ☒ Implicit (please specify)

The data were likely collected at Columbia University, where the study was conducted.

Are there other important features of data collection?

☒ Details

EEG was recorded during the first math test. The retest was a surprise given 24 hours later.

Methods - Data analysis***Which methods were used to analyse the data?***

☒ Explicitly stated (please specify)

The study used univariate analyses (ANOVAs/ANCOVAs) and structural equation modeling (SEM).

Which statistical methods, if any, were used in the analysis?

☒ Details

ANOVAs/ANCOVAs, t-tests, and structural equation modeling were used.

What rationale do the authors give for the methods of analysis for the study?

☒ Details

The authors explain that they used both univariate and multivariate approaches to understand the relationships between feedback response, tutor use, and learning success as a function of stereotype threat.

For evaluation studies that use prospective allocation, please specify the basis on which data analysis was carried out.

☒ Not applicable (not an evaluation study with prospective allocation)

Do the authors describe any ways they have addressed the reliability of data analysis?

☒ Details

The authors used multiple goodness-of-fit indices for their SEM analysis.

Do the authors describe any ways they have addressed the validity of data analysis?

☒ Details

The authors explain their rationale for using different analytical approaches and how these address their research questions.

Do the authors describe strategies used in the analysis to control for bias from confounding variables?

☒ Details

The authors included math SAT scores and first-test performance as control variables in their analyses.

Please describe any other important features of the analysis.

☒ Details

The authors used a median split to categorize participants as “better” or “poorer” learners for some analyses.

Please comment on any other analytic or statistical issues if relevant.

☒ Details

The authors note that they excluded some participants from EEG analysis due to insufficient trial counts.

Results and Conclusions

How are the results of the study presented?

☒ Details

Results are presented in text, tables, and figures, including ERP waveforms and structural equation models.

What are the results of the study as reported by authors?

☒ Details

Key findings include: 1) Stereotype threat impaired initial math test performance. 2) Under stereotype threat, greater initial salience of errors (FRN) predicted less exploration of tutorial information. 3) Under stereotype threat, sustained attention to negative feedback (LPP) predicted poor learning from tutorial information. 4) These emotional responses to feedback were less predictive of learning outcomes in the non-threat condition.

Was the precision of the estimate of the intervention or treatment effect reported?

- CONSIDER:
 - Were confidence intervals (CIs) reported?

☒ No

Are there any obvious shortcomings in the reporting of the data?

☒ No

Do the authors report on all variables they aimed to study as specified in their aims/research questions?

☒ Yes (please specify)

The authors report on all key variables mentioned in their research questions, including emotional responses to feedback, tutorial use, and learning success.

Do the authors state where the full original data are stored?

☒ No

What do the author(s) conclude about the findings of the study?

☒ Details

The authors conclude that stereotype threat increases the dependence between females' emotional responses to negative feedback and their error correction success. They suggest that stereotype threat can undermine learning through either reduced quality or quantity of engagement with learning opportunities, linked to different components of the emotional response to negative feedback.

Quality of the study - Reporting

Is the context of the study adequately described?

☒ Yes (please specify)

The authors provide adequate context, describing the background of stereotype threat research and the rationale for examining its effects on learning.

Are the aims of the study clearly reported?

☒ Yes (please specify)

The study's aims to examine how stereotype threat affects emotional responses to feedback and subsequent learning are clearly stated.

Is there an adequate description of the sample used in the study and how the sample was identified and recruited?

☒ No (please specify)

The paper lacks details on how participants were identified and recruited.

Is there an adequate description of the methods used in the study to collect data?

☒ Yes (please specify)

The methods for collecting math performance, ERP, and tutorial use data are well described.

Is there an adequate description of the methods of data analysis?

☒ Yes (please specify)

The univariate and multivariate analysis methods are adequately described.

Is the study replicable from this report?

☒ No (please specify)

Some key details, such as recruitment methods and exact instructions, are missing.

Do the authors avoid selective reporting bias?

☒ Yes (please specify)

The authors report on all variables mentioned in their research questions.

Quality of the study - Methods and data***Are there ethical concerns about the way the study was done?***

☒ No concerns

Were students and/or parents appropriately involved in the design or conduct of the study?

☒ No (please specify)

There is no mention of student involvement in study design or conduct.

Is there sufficient justification for why the study was done the way it was?

☒ Yes (please specify)

The authors provide a clear rationale for examining emotional responses to feedback under stereotype threat.

Was the choice of research design appropriate for addressing the research question(s) posed?

☒ Yes (please specify)

The experimental design with ERP measures was appropriate for examining the effects of stereotype threat on emotional processing and learning.

To what extent are the research design and methods employed able to rule out any other sources of error/bias which would lead to alternative explanations for the findings of the study?

☒ A little (please specify)

While the study controls for some variables (e.g., math SAT), other potential sources of bias (e.g., selection bias) are not fully addressed.

How generalisable are the study results?☒ Details

The results may be generalizable to female undergraduate students in math contexts, but generalizability to other populations or settings is limited.

Weight of evidence - A: Taking account of all quality assessment issues, can the study findings be trusted in answering the study question(s)?☒ Medium trustworthiness (please specify)

The study uses appropriate methods and analysis techniques to address its research questions. However, some limitations in sampling and recruitment details, as well as the lack of randomization information, slightly reduce its trustworthiness.

Have sufficient attempts been made to justify the conclusions drawn from the findings so that the conclusions are trustworthy?☒ High trustworthiness

The authors provide a thorough discussion of their findings, linking them to existing theory and research. They consider alternative explanations and acknowledge limitations of their study.

COHORT STUDIES

This study does not fit the criteria for a cohort study, so this section is not applicable.

CASE CONTROL STUDIES

This study does not fit the criteria for a case control study, so this section is not applicable.

DOES THIS REVIEW ADDRESS A CLEAR QUESTION?***Did the review address a clearly focussed issue?***

- Was there enough information on:
 - The population studied
 - The intervention given
 - The outcomes considered

☒ Yes

The study clearly focuses on the effects of stereotype threat on female students' math performance and learning, examining emotional responses to feedback as measured by ERPs.

Did the authors look for the appropriate sort of papers?

- The 'best sort of studies' would:
 - Address the review's question
 - Have an appropriate study design

☒ Yes

This is not a review paper, but an original research study with an appropriate experimental design to address its research questions.

ARE THE RESULTS OF THIS REVIEW VALID?

Do you think the important, relevant studies were included?

Not applicable - this is not a review paper.

Did the review's authors do enough to assess the quality of the included studies?

Not applicable - this is not a review paper.

If the results of the review have been combined, was it reasonable to do so?

Not applicable - this is not a review paper.

WHAT ARE THE RESULTS?

What is the overall result of the review?

Not applicable - this is not a review paper. However, the main findings of this study are: 1) Stereotype threat impaired initial math test performance. 2) Under stereotype threat, greater initial salience of errors predicted less exploration of tutorial information. 3) Under stereotype threat, sustained attention to negative feedback predicted poor learning from tutorial information.

How precise are the results?

☒ Can't tell

The paper does not report confidence intervals, making it difficult to assess the precision of the results.

WILL THE RESULTS HELP LOCALLY?

Can the results be applied to the local population?

☒ Can't tell

The results may be applicable to female undergraduate students in similar educational settings, but generalizability to other populations or contexts is uncertain.

Were all important outcomes considered?

☒ Yes

The study considered math performance, emotional responses to feedback, tutorial use, and learning outcomes.

Are the benefits worth the harms and costs?

☒ Yes

The study provides valuable insights into the mechanisms of stereotype threat effects on learning, with no apparent harm to participants. The potential benefits in understanding and addressing stereotype threat effects likely outweigh the costs of conducting the study.

References

- Mangels, J. A., Good, C., Whiteman, R. C., Maniscalco, B., & Dweck, C. S. (2012). Emotion blocks the path to learning under stereotype threat. *Social Cognitive and Affective Neuroscience*, 7(2), 230–241. <https://doi.org/10.1093/scan/nsq100>