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Research Article

The individual level effect of symbolic representation: An experimental study on teacher-student gender congruence and students' perceived abilities in math

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Abstract: Studies on representative bureaucracy have often confirmed the positive performance effects of bureaucracies mirroring the demographic characteristics of their clientele. However, little is known about the underlying individual level mechanisms leading to these outcomes. In this study, theoretical ideas from representative bureaucracy literature and social and educational psychology are combined in a new model that explains effects of passive representation from the perspective of the individual client in the educational field. It is hypothesized that positive effects of gender congruence on students' academic self-concepts are mediated by gender stereotypical beliefs of students. This mediation is expected to be moderated by the self-confidence of the teacher. Results of a survey experiment among students in a Dutch high school do not support the hypothesized relationships. The study does reveal gender differences in stereotypical beliefs and academic self-concepts though. Furthermore, the academic self-concept for math of both male and female students is higher if the math teacher is a woman. The study concludes with a discussion of the findings and avenues for future research on the role of stereotypical beliefs in the association between gender representation and student performance.

Keywords: Stereotypes, Stereotypical beliefs, Gender congruence, Academic self-concepts, Passive representation, Symbolic representation, Representative bureaucracy, Education

Supplements: Open data, Open materials

Representative bureaucracy literature argues that governmental organizations should mirror demographic characteristics of their clientele because representative organizations would meet democratic values and perform better (Groeneveld & Van de Walle, 2010; Keiser, Wilkins, Meier & Holland, 2002; Meier, Wrinkle & Polinard, 1999; Sowa & Selden, 2003). Although positive effects of representation have been confirmed by a variety of studies, little is known about underlying individual level mechanisms explaining these effects. This may be attributed to the aggregate level of analysis of most studies, making it impossible to identify theoretical mechanisms that are grounded in the behavior of individual bureaucrats and clients (Nicholson-Crotty, Grissom, Nicholson-Crotty & Redding, 2016).

The literature distinguishes between active, passive and symbolic representation. Positive effects of representation are generally attributed to bureaucrats being actively representative, meaning that bureaucrats (intentionally) act to improve outcomes for the clients they represent (e.g. Meier, Doerfler, Hawes, Hicklin & Rocha, 2006). The presence of minority bureaucrats may also indirectly affect outcomes for minority clients by creating an organizational culture in which nonminority bureaucrats become aware of the interests and needs of minority clients (Nicholson-Crotty et al., 2016). Symbolic representation shifts the focus from the bureaucrat to the perspective of the client and assumes that clients' attitudes and behavior change as a result of the mere presence

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of bureaucrats with a similar background (e.g. Gade & Wilkins, 2013).

Only a handful of studies have focused on individual level effects of symbolic representation (e.g. Gade & Wilkins, 2013; Guul, 2018; Nicholson-Crotty et al. 2016; Song, 2018; Theobald & Haider-Markel, 2008). For instance, Guul (2018) found that clients increased their job seeking efforts if they were matched with a job counselor with the same gender. Still, much remains unknown as to what psychological processes on the part of the client are responsible for changes in clients' attitudes and behavior. The present study, which focuses on the field of education, unravels one possible mechanism explaining individual effects of symbolic representation by combining representative bureaucracy literature with insights from social and educational psychology.

Educational performance is strongly dependent on students' perceived abilities, referred to as academic self-concepts (e.g. Marsch, Byrne & Shavelson, 1988). For subjects with gender related stereotypes connected to them, students' academic self-concepts are argued to be influenced by stereotypical beliefs (Beilock, Gunderson, Ramirez & Levine, 2010; Marsch et al., 1988; Pajares & Miller, 1994). Combining these insights with representative bureaucracy literature, it is hypothesized that gender congruence in the student-teacher relationship in math education positively affects academic self-concepts, because the teacher either confirms (for male students) or rejects stereotypes (for female students) connected to the subject. The empirical study is therefore guided by the following research question: *How does teacher-student gender congruence influence the academic self-concepts of female and male students?*

Representative Bureaucracy and Performance in Education

A lot of research on representative bureaucracy focusses on the educational sector. Education is one of the largest branches of the public sector and a cornerstone of our society in that it builds the knowledge and skills of citizens (Meier & Stewart, 1992). The three mechanisms underlying representation and performance are argued to occur in education. Teachers may for instance tailor their teaching to the needs of students they represent in order to increase these students' performance, or use terms during class and in test questions that are culturally sensitive. Teachers may also inform their nonminority colleagues about qualities and needs of minority students, which leads them to adjust their teaching methods to minority students' needs, increasing their performance (Grissom, Kern & Rodriguez, 2015). The mere presence of a representative teacher may also affect represented students' performance as a result of attitudinal and behavioral changes on the part of the student.

Symbolic representation explains performance effects of representation from the perspective of the client. Clients are argued to be more responsive to, and receptive of bureaucrats with a similar background (Gade & Wilkins, 2013; Guul, 2018). When confronted with a bureaucrat of a similar background, the represented client may (unwittingly) change his or her attitude, behavior and cooperation with a program or policy, increasing the output for him or herself. Hence, students may change their attitudes and behavior as a consequence of the presence of a teacher with a similar background: school identification may increase, a representative teacher may be a role model, or a teacher may reject certain stereotypes, all of which can increase student performance (Beilock et al., 2010; Grissom et al., 2015; Zhang, 2018).

Symbolic Representation, Stereotypes and Academic Self-Concepts

Studies on symbolic representation have studied its effects as a change in observable behavior or attitudes of clients such as changes in effort for or judgements about a program (Guul, 2018; Nicholson-Crotty, 2016). However, studying less observable processes underlying changes in behavior, attitudes and performance may help to better understand why and how effects of symbolic representation occur in an educational setting. Studies in educational and social psychology point at the role of stereotypes and self-concepts in students' performance. Studies show that student performance is strongly dependent on students' academic self-concepts, i.e., beliefs of self-worth, and judgements about one's performance in a subject (e.g. Pajares & Miller, 1994). Stereotypical beliefs are argued to influence these academic self-concepts (e.g. Beilock et al., 2010).

A strong gender stereotype about math (i.e. men are good at math and women are bad at math) is expected to affect female and male students' beliefs and judgements about their own performance in math. Studies on gender differences in academic self-concepts in math suggest that those differences can be attributed to stereotypical beliefs about the subject

(Marsh et al., 1988; Pajares & Miller, 1994). This idea is confirmed by many scholars; multiple studies found a difference in female and male students' math performance and partly attributed it to the stereotypical belief connected to the subject (Beilock et al., 2010; McFarland, Murray & Phillipson, 2016; Steele, 2003; Zhang, 2018).

Teacher-student gender congruence, which is the gender match between teacher and student, is expected to impact the aforementioned psychological processes in students. A teacher can serve as evidence for or against the stereotype connected to math, influencing students' stereotypical beliefs and academic self-concepts. Female students are expected to perform better with a female teacher because a female teacher serves as evidence against the stereotype that women are bad at math. The rejection of the stereotype decreases female students' stereotypical beliefs, thereby increasing their beliefs and judgements about their capabilities and performance. The stronger academic self-concepts result in better performance. Vice versa, male students' performance would increase with a male teacher, because a male teacher confirms the stereotype that men are good at math, strengthening the male students' stereotypical belief which in-turn strengthens their academic self-concepts and performance. This results in the following hypotheses:

H1. Teacher-student gender congruence increases students' academic self-concepts.

H2. The effect of teacher-student gender congruence on academic self-concepts is mediated by stereotypical beliefs.

The self-confidence of the teacher might moderate the relationship between gender congruence and stereotypical beliefs. For instance, Beilock et al. (2010) show that girls' self-confidence in math decreases if their female teacher is anxious about teaching math. By being anxious, the female teacher confirms the negative stereotypical belief about math rather than rejecting it. In this case, female students' stereotypical beliefs may be stronger with an insecure female math teacher, because she confirms stereotypical beliefs, reducing female students' academic self-concept.

H3. The indirect effect of gender congruence on academic self-concepts is moderated by teacher self-confidence.

The conceptual model is depicted in Figure 1.

Methods

An online survey experiment was conducted to test the hypotheses. The survey experiment was run at a Free Reformed high school that teaches regular education in the three main educational levels of the Dutch secondary education system. Because of the religious character of the school, it is difficult to generalize the findings of this study to other school contexts. However, the weak external validity of the study is compensated for by the strong internal validity of the experimental design. Furthermore, the religious character of the high school may increase gender socialization. As a result, the variation in stereotypical beliefs among students is expected to be rather low. This low variation makes it harder to find effects of the manipulation on students' stereotypical beliefs. If an effect is found in this setting, it will be even more likely the effect will be found in other school contexts.

The sample (N = 410) was drawn from the third and fourth grades from all educational levels.[1] Students' timetables determined which classes were able to participate in the survey. In consultation with the schedulers of the school, five classes from the lowest educational high school level, six classes from the intermediate level, and six classes from the highest educational level were selected. The survey experiment took place during mentoring hours in computer classrooms.

Respondents were presented a vignette describing the characteristics of a math teacher (Figure 2). The information on the vignette varied in terms of the gender of the teacher (female/male) and the self-confidence of the teacher (unconfident/confident), resulting in four experimental groups (Table 1). Based on the last digit of the students' six-digit student number (which is based on the moment of registration at the high school), students were randomly assigned to one of the four experimental groups.

Variables

Gender of the teacher

The gender of the teacher in the vignette was indicated by the names Anouk (popular Dutch female name) and Daan (popular Dutch male name) and the pronouns 'she' and 'he' (see Figure 2). A dummy variable was created with a value of '1' for a female teacher and a value of '0' for a male teacher.

Figure 1
Conceptual Model

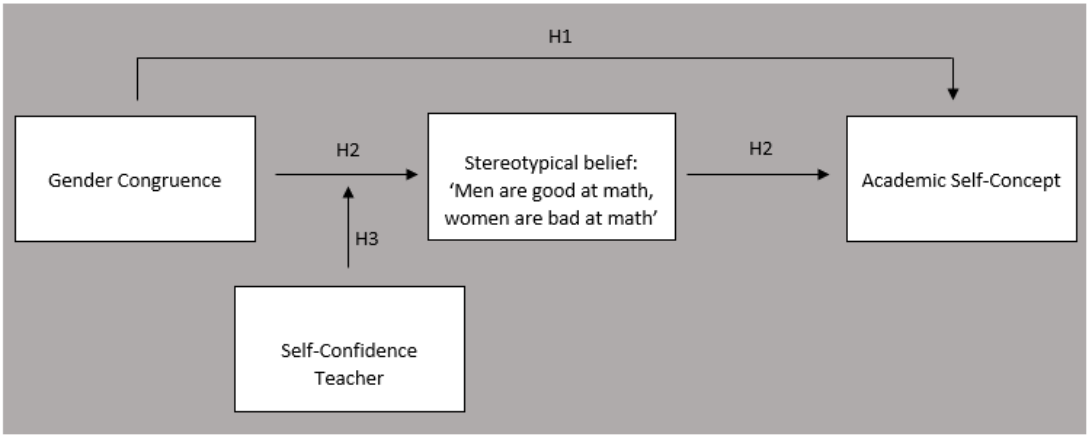


Table 1
2x2 Survey Experiment Design

		Gender Math Teacher	
		Female	Male
Self-Confidence Math Teacher	Unconfident	Group 1	Group 3
	Confident	Group 2	Group 4

Figure 2
Text Vignette

> [1.Anouk/2.Daan] is a math teacher on a high school. [1.She/2.He] has always found math very interesting. [1.She/2.He] achieved good grades for math in high school and then started studying mathematics. [1.She/2.He] teaches math to all levels for 5 years now, [a. but still finds it very scary. [1.She/2.He] stumbles over words, drops a chalk or gets red when [1.she/2.he] explains something./b. but still really enjoys it. [1.She/2.He] finds fun ways to make math problems less boring and stands with visible pleasure in front of the class.] [a. Nevertheless, [1.her/2.his] boss is happy with [1.her/2.him] and [1.she/2.he] hopes to continue teaching for a while./b. [1.Her/2.His] boss is happy with [1.her/2.him] and [1.she/2.he] hopes to continue teaching for a while.]

Self-confidence teacher

Self-confidence of the teacher is measured by describing the teacher as insecure (using characteristics such as 'turning red', 'dropping the chalk', 'stumbling words') or self-confident (using characteristics such as 'making math fun', and 'enjoying teaching', see Figure 2). A dummy variable was created with a value of '1' for a self-confident teacher and a value of '0' for an unconfident teacher. A manipulation check confirms that this manipulation was successful ($r = 0.831$; $p<0.01$).

Gender of the student

The gender of the respondent was measured by using the categories 'male', 'female', 'I cannot say' and 'I do not want to say'. Two students chose the option 'I cannot say' and one student chose 'I do not want to

Table 2
Descriptive Statistics and Correlations (n = 394)

		Mean	Std. dev.	Min.	Max.	(1)	(2)	(3)	(4)	(5)
(1)	Gender student (female = 1)	.56	.50	0	1	1.000				
(2)	Gender teacher (female = 1)	.51	.50	0	1	.055*	1.000			
(3)	Confidence teacher (self-confident = 1)	.51	.50	0	1	.014	-.015	1.000		
(4)	Average math grade	6.76	1.20	2.6	9.9	.146*	.014	-.010	1.000	
(5)	Stereotypical beliefs	2.36	.90	1	5	-.264*	-.057*	.008	-.057*	1.000
(6)	Academic self-concept	3.39	.88	1	5	-.111*	.086*	-.011	.560*	-.154*

* $p < 0.05$

say'. These answers were coded as missing. A dummy variable was created with a value of '1' for a female student and a value of '0' for a male student.

Stereotypical belief

Stereotypical belief taps the extent to which respondents believe the idea that men are good at math and women are bad at math. Stereotypical belief is measured using eight items (for the exact items see Supplementary Appendix A). Four items were based on the gender schema measurement scale of Smetackova (2015). A pre-test of the survey demonstrated that the items based on the Smetackova (2015) measure were interpreted as too extreme, which might result in low variation. Therefore, four additional more nuanced statements were included. Respondents were asked to respond to the statements on a 5-point Likert scale (1 'totally agree', 5 'totally disagree'). The variable stereotypical belief is constructed by calculating the average of the items for each respondent (Alpha=0.937).

Academic self-concept

Academic self-concept taps the respondents' beliefs in and judgements of their mathematical abilities. To measure the academic self-concept, six statements from Arens, Marsh, Pekrun, Lichtenfeld, Murayama and vom Hofe (2017) as well as four statements from the TIMMS study (for the exact items see Supplementary Appendix A) were used.[2] Adding the more emotionally focused statements of the TIMMS study creates a measurement scale that measures both rational and emotional aspects of the academic self-concept. Respondents were asked to respond to the statements on a 5-point Likert scale (1 'totally true', 5 'totally false'). The variable academic self-concept is constructed by calculating the average of the items for each respondent (Alpha=0.942).

Average math grade

Because extant research shows that prior achievement in a subject greatly influences the academic self-concept for that subject (e.g. Marsh et al., 1988), the respondent's average grade for math will be included in the model as a covariate. In the Netherlands, most institutions grade exams, papers and theses on a scale from 1 (very poor) to 10 (outstanding). Students were asked to look up their average grade for math (rounded to one decimal place) before filling in the survey. Students could answer '0' if they did not want to share their average grade, which is coded as missing. Adding average grade for math to the models will soak up noise in the dependent variable (academic self-concept) that might exist due to possible over (or under) estimation of one's mathematical abilities (c.f., Wang, Sparks, Gonzales, Hess, & Ledgerwood, 2017).

After a listwise deletion of respondents who have missing values on the variables used in the analyses, the total number of observations is 394. Table 2 shows descriptive statistics of and correlations between the variables in the analysis. The results show that there is no correlation between students' average math grade and the manipulations of gender of the teacher and teacher confidence, which is a prerequisite for using independent covariates in experimental designs (Wang et al., 2017).

Table 3
Direct Effects of Moderated Mediation Analysis (unstandardized coefficients; n = 394)

	Model 1	Model 2	Model 3
	Coef.	Coef.	Coef.
M = Stereotypical beliefs			
Gender student (1 = female)	-.472***	-.531***	-.674***
	(.092)	(.124)	(.184)
Gender teacher (1 = female)	-.077	-.143	-.341+
	(.088)	(.131)	(.181)
Confidence teacher (1 = self-confident)			-.159
			(.171)
Average math grade	-.014	-.014	-.015
	(.036)	(.035)	(.036)
Gender student * Gender teacher		.119	.427+
		(.176)	(.248)
Gender student * Confidence teacher			.277
			(.251)
Gender teacher * Confidence teacher			.407
			(.264)
Gender student * Gender teacher * Confidence teacher			-.624+
			(.357)
Constant	2.754***	2.788***	2.883***
	(.242)	(2.34)	(.258)
Y = Academic self-concept			
Stereotypical beliefs	-.176***	-.176***	-.176***
	(.044)	(.044)	(.044)
Gender student	-.439***	-.433***	-.433***
	(.075)	(.099)	(.103)
Gender teacher	.142*	.148	.148
	(.069)	(.102)	(.101)
Average math grade	.425***	.425***	.425***
	(.029)	(.029)	(.029)
Gender student * Gender teacher		-.012	-.012
		(.139)	(.139)
Constant	1.106***	1.103***	1.103***
	(.237)	(.246)	(.241)
var(e.m)	.756	.756	.749
	(.045)	(.044)	(.046)
var(e.y)	.466	.466	.466
	(.032)	(.031)	(.032)

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 3
Adjusted Predictions of Two-Way Interaction with 90% Cis

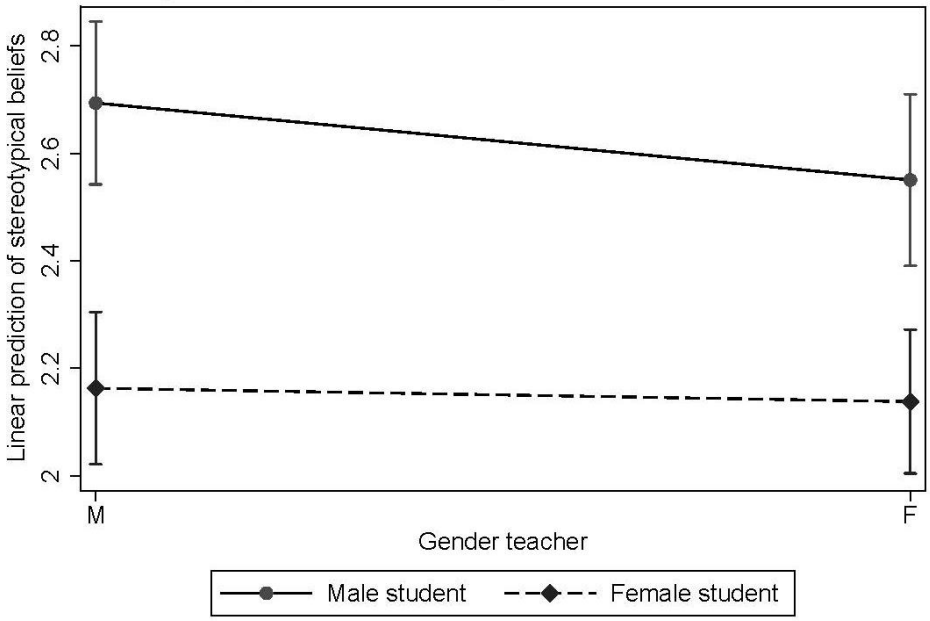
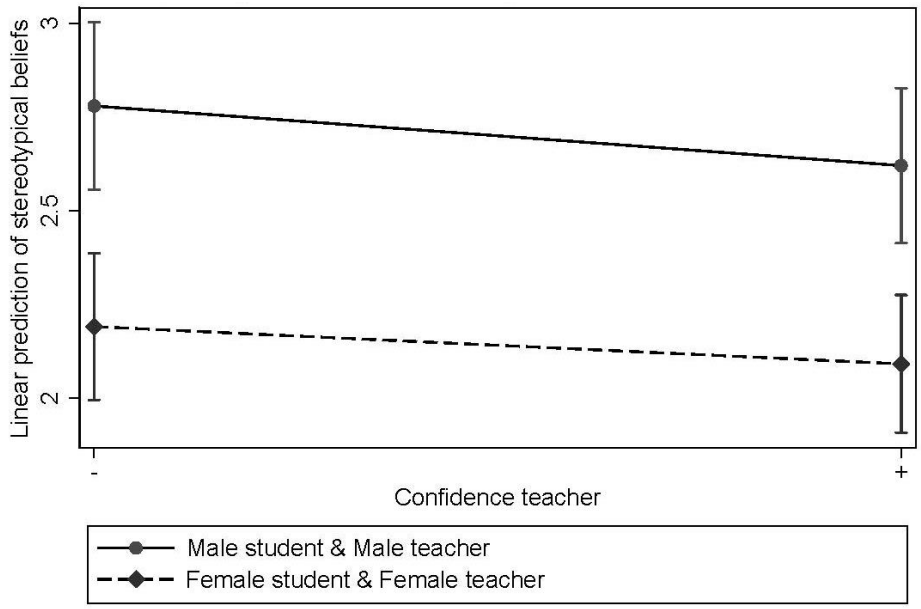


Figure 4
Adjusted Predictions of Three-Way Interaction with 90% Cis



Results

To test the hypotheses, a moderated mediation analysis was carried out using STATA 15's 'sem' command. The direct effects of the moderated mediation analysis on academic self-concepts are presented in Table 3. In the first model, the effects of gender of the student (with male student as the reference category) and gender of the teacher (with male teacher as the reference category) are assessed as independent

Table 4
Indirect effects of moderated mediation analysis (unstandardized coefficients; n = 394)

	Model 1	Model 2	Model 3
	Coef.	Coef.	Coef.
Gender student (1 = female)	.083**	.094**	.119**
	(.025)	(.030)	(.039)
Gender teacher (1 = female)	.014	.025	.060+
	(.016)	(.023)	(.033)
Confidence teacher (1 = self-confident)			.028
			(.030)
Average math grade	.002	.002	.003
	(.006)	(.006)	(.006)
Gender student * Gender teacher		-.021	-.075+
		(.031)	(.044)
Gender student * Confidence teacher			-.049
			(.044)
Gender teacher * Confidence teacher			-.072
			(.048)
Gender student * Gender teacher * Confidence teacher			.110+
			(.065)

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

variables. In the second model, the effect of gender congruence is tested by adding a two-way interaction term for gender of the student and gender of the teacher. Finally, in the third model, the moderating effect of teacher confidence (with unconfident as the reference category) is tested by adding a three-way interaction term for gender of the student, gender of the teacher, and teacher confidence. The structure of the third model mirrors Hayes's (2018) conditional moderated mediation model (Model 13). For each model, bootstrapping (N = 5,000) is used to obtain normal-based bootstrapped confidence intervals around the indirect effect. Table 4 presents the indirect effects of the moderated mediation analysis.

The first part of Model 1 tests the effect of gender of the student and gender of the teacher on the mediator variable, stereotypical beliefs, without the two-way interaction term. The results show that gender of the student has a statistically significant, negative effect on stereotypical beliefs, indicating that female students have weaker stereotypical beliefs about gender and math than male students. The effect of gender of the teacher is not statistically significant. Whether the teacher is male or female makes no difference in explaining students' stereotypical beliefs.

The second part of Model 1 tests the effect of gender of the student and gender of the teacher on the dependent variable, academic self-concepts. The variable stereotypical beliefs has a statistically significant, negative effect on academic self-concept. Hence, the stronger one's stereotypical beliefs about gender and math, the lower one's academic self-concept. The effect of gender of the student is also statistically significant, indicating that female students have a lower academic self-concept than male students. Moreover, the results show that, in general, students with a female teacher have a higher academic self-concept than students with a male teacher. In addition, students with a higher average for math have a higher academic self-concept.

Hypothesis 1 predicts that gender congruence increases students' academic self-concepts, and Hypothesis 2 predicts that this effect is mediated by stereotypical beliefs. To test these hypotheses, an interaction term for gender of the student and gender of the teacher was added to Model 2. The results of Model 2 show that the effects of the interaction term

on both stereotypical beliefs and academic self-concept are not statistically significant. Figure 3 depicts the predictive margins of stereotypical beliefs for the two-way interaction term. It shows that there is a significant difference in the stereotypical beliefs of male and female students, but this effect is not moderated by the gender of the teacher. Moreover, Table 4 shows that the indirect effect of the two-way interaction term on academic self-concepts is not statistically significant. Hence, gender congruence has no direct effect on academic self-concepts and this effect is not mediated by students' stereotypical beliefs, which means that Hypotheses 1 and 2 cannot be corroborated.

Hypothesis 3 predicts that the indirect effect of gender congruence on stereotypical beliefs is moderated by teacher confidence. For example, when confronted with an unconfident female teacher, girls' stereotypical beliefs will be stronger compared to situations in which female students are confronted with a confident female teacher. Model 3 tests the effect of the three-way interaction term for gender of the student, gender of the teacher, and teacher confidence on stereotypical beliefs. The results show that the three-way interaction term is statistically significant at the 90 percent confidence level. The coefficients for the independent variables that predict academic self-concept are, logically, the same as those in Model 2.[3] Table 4 shows that the indirect effect of the three-way interaction term is also statistically significant at the 90 percent confidence level.

To better understand the effects of the interaction term, the predictive margins for the three-way interaction term are depicted in Figure 4. Figure 4 only depicts the effects for teacher-student gender congruence. It shows that, for both male and female gender congruence, the effect of teacher confidence on stereotypical beliefs is negative, but lacks statistical significance. In other words, the effect of the interaction between gender of the student and gender of the teacher is not moderated by teacher confidence. The fact that the three-way interaction in Model 4 is significant can in all likelihood be explained by the effect of the gender of the student. Hence, the indirect effect of gender congruence on academic self-concepts is not moderated by teacher confidence, which means that Hypothesis 3 cannot be corroborated.[4]

Discussion and Conclusion

Integrating insights from educational and social psychology in representative bureaucracy theory, this study examined a mechanism through which individual level teacher-student gender congruence would lead to an increase in academic self-concepts of students in math in secondary education. A survey-experiment was conducted to test hypotheses on the association between teacher-student gender congruence, stereotypical beliefs about gender and math, and academic self-concepts. To soak up any noise in the dependent variable academic self-concept that might exist due to over estimation of students' academic self-concept, all models included students' average grade for math.

Based on the representative bureaucracy literature, it was hypothesized that gender congruence increases academic self-concepts for both female and male students, but no positive effects were found. Using insights from social and educational psychology it was further hypothesized that stereotypical beliefs mediate the relationship between teacher-student gender congruence and academic self-concepts and that this mediation is moderated by the self-confidence of the teacher. The analysis found no statistically significant interaction effects of gender of the teacher and gender of the student on both stereotypical beliefs and academic self-concepts. The effect of a three-way interaction of gender of the student, gender of the teacher, and teacher confidence on stereotypical beliefs was statistically significant; however, predictive margins showed no significant effects for the three way interaction for teacher-student gender congruence specifically. In all, the analyses did not support the hypotheses.

The analyses showed a dominant effect of the gender of the student on both stereotypical beliefs and academic self-concepts. The difference in academic self-concepts for female and male students is consistent with the literature about gender differences in math (e.g. Marsch et al. 1988). As educational and social psychology suggest, stereotypical beliefs might explain differences in math performance of female and male students. These effects, however, are relatively modest which could be explained by the fact that average math scores were added to the models. The statistically significant relationships between gender of the student, stereotypical beliefs and academic self-concepts indeed strengthen the belief in a mediating role of stereotypical beliefs. The analyses also showed a positive effect

of gender of the teacher on students' academic self-concept, meaning that both male and female students' academic self-concepts increase with a female teacher. Whereas studies on individual level effects of representation tend to focus on representation effects for the represented, the results of this study suggest that representation of stereotypically disadvantaged groups might be beneficial for both the represented and non-represented group.

Although this study found significant effects for the gender of the student on stereotypical beliefs, and significant effects for gender of the student and gender of the teacher on academic self-concepts of students, effects for teacher-student gender congruence on stereotypical beliefs and academic self-concepts were not found. The lack of support for effects of teacher-student gender congruence might be caused by limitations of the study's methodology. Stereotypical beliefs were measured through items that explicated stereotypical beliefs. While, if explicitly asked, people tend to disagree with gender stereotypical beliefs to a higher degree, they may still have an implicit bias regarding the competencies of men and women in specific areas of expertise such as math (Steffens & Jelenec, 2011). Future research should therefore explore methods that allow for the measurement of implicit associations between gender and competencies in math, such as implicit association tests.

Moreover, lack of support for the hypotheses may be caused by the experimental design of the study. Stereotypical beliefs and academic self-concepts of students might be influenced by characteristics of their teacher as a result of the regular interactions students and teachers repeatedly have, over a longer time period. The survey experiment also might not have been able to capture a real-life teacher-student relationship but instead may have tested the effect of passive representation in the short term. The finding that representation does not have an effect in the short term raises the question if, on what terms, and after how many interactions effects of symbolic representation do occur. These considerations provoke interest in further testing of the proposed model with other methods.

This study contributed to representative bureaucracy literature by combining two theoretical ideas into a new model explaining individual level effects of symbolic representation. Although the hypotheses were not supported by the data, the results call for further exploration of the hypothesized mechanism. Significant gender differences in stereotypical beliefs and academic self-concepts and a significant effect of gender of the teacher on academic self-concepts of both male and female students provoke interest in further exploration of the role of teacher gender in aforementioned psychological processes in students. Such research could shed further light on the role stereotypical beliefs of citizen-clients may play in their reception of public services being delivered by public professionals with different backgrounds.

Notes

1. In the Netherlands the educational system exists of primary education (one level, grade 1 to 8; age 4 till 12) and secondary education. Secondary education exists of three educational levels in which grades are starting from 1 again: VMBO (lowest level; prepares for vocational education, grade 1 to 4; age 12 till 16), HAVO (intermediate level; prepares for applied sciences, grade 1 to 5; age 12 till 17) and VWO (highest level; prepares for university, grade 1 to 6; age 12 till 18).
2. TIMMS & PIRLS (2015). About TIMMS 2015. Retrieved from: https://timssandpirls.bc.edu/timss2015/
3. The coefficients predicting academic self-concept slightly differ across the models due to bootstrapping.
4. Since students were exposed to the math teacher's gender and confidence at the same time, one could argue that the confidence of the teacher dampens the effect of gender congruence. As a robustness check, we ran the analyses on a subsample without the unconfident teachers. The results confirmed the results of the original analyses on the total sample.

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