



# Girls Are Better Students but Boys Will Be More Successful at Work: Discordance Between Academic and Career Gender Stereotypes in Middle Childhood

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## Abstract

Despite findings of female advantages at school, men still are higher achieving in the workplace. Only a small amount of research has simultaneously investigated stereotypes of these different domains. We investigated whether stereotypes about academic female superiority and paradoxical stereotypes about workplace male superiority coexist. Participants were 1144 Grades 1–6 students ( $M_{\text{age}} = 9.66$ ) from Hong Kong. They completed measures of academic gender stereotypes and meta-stereotypes, career gender stereotypes, career-related motivation for school excellence, and school engagement. Teachers provided school exam scores. We examined (1) gender and age differences, (2) the relationship between the stereotypes, and (3) the moderating role of these stereotypes in gender differences in school engagement, exam scores, and career-related motivation. Both boys and girls perceived girls as better students but a belief in female superiority did not translate to the career domain. Although both boys and girls beginning primary school believed their gender was superior in both domains, those at the end of primary school believed that girls do better at school while men are more successful at work. Also, at the end of primary school, these two stereotypes were more discordant on the individual level, i.e., the tendency for children who believed that girls perform better at school to also believe that women perform better at work was weaker in older children. Academic gender stereotypes moderated gender differences in school engagement and exam scores. Understanding why children hold discordant beliefs about success in different arenas and combating both academic and career stereotypes early may help improve gender equality for both genders.

**Keywords** Gender stereotypes · Developmental pattern · Academic · Career · Middle childhood

## Introduction

Despite improvements in equality, gender disparity still exists in many domains. Horizontal occupational gender segregation is reflected in gendered occupational choices and vertical occupational gender segregation is reflected in occupational prestige, status, earning, and leadership positions (Lippa, 2010; United Nations, 2016). Children's stereotyped beliefs potentially contribute to these differences (Bian, 2022;

Ellemers, 2018). Although career stereotypes usually favor men, recent work suggests that girls do better at school overall (Voyer & Voyer, 2014) and are perceived as better students than boys (Hartley & Sutton, 2013). Discordant stereotypes about academic and career success may seem curious, given that the former strongly predicts the latter (Kell et al., 2013). Descriptive stereotypes ("what is") develop early and readily become prescriptive stereotypes ("what should be"), which then bias people's choices and expressions (Roberts, 2022). Real world experiments showed that stereotypes bias external behavior when people are unaware of the stereotypes they hold (Regner et al., 2019). It is thus important to investigate children's beliefs about the prototypical male and female at school and at work. However, little is known about the developmental differences and order in which boys and girls develop these stereotypes and the relationship between them. We examined academic gender stereotypes and career gender stereotypes about success in these domains using existing

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and new measures in a large primary school sample. We also examined how these stereotypes related to behavioral indicators of academic success (i.e., school engagement and exam scores) and career-related motivation for school excellence.

### Gender Differences in Occupational Preferences and Achievement

Currently, women remain under-represented in STEM (science, technology, engineering, and mathematics), arguably the more “favorable jobs” because they usually afford higher earning and status (Liben & Coyle, 2014). In the US, from 1972 to 2010, women were persistently under-represented in things-oriented occupations such as those in STEM, with only 15% of workers in the 20 most things-oriented jobs being women in 2010 (Lippa et al., 2014). In Asia, even fewer women are in science and technology (18.9%, compared to 34.5% in Europe; The Association of Academies and Societies of Sciences in Asia, 2015).

Moreover, women earn less than men and are less likely to get promoted to leadership roles, thus having lower occupational status (United Nations, 2016). Although gender wage gaps have reduced over time, they remain significant across countries, for example, in the UK and the US, even when women and men hold similar educational qualifications (Bobbitt-Zeher, 2007). The gender wage gap is even larger in Asia, being 24.5% in Japan and 34.6% in South Korea in 2017 (Organization for Economic Co-operation and Development [OECD], 2017). Also, across cohorts and ages, men have higher promotion rates and occupational attainment (Bukodi et al., 2012). In 2004, women only held 32% of the managerial positions across Europe and 10.4% of seats as a board member in the decision-making body of companies worldwide (Holst, 2006). These patterns are similar across the West and the East, with women in the UK and the US sharing over 20% of seats on boards, while women in China, Japan and Korea having a share of 9.7%, 5.3%, and 2.1%, respectively (OECD, 2017).

### Children’s Career Stereotypes

Gendered preferences and achievement at work likely have complex roots, but children’s stereotypes may be a key contributor (Bian, 2022; Ellemers, 2018). Awareness of differences in men’s and women’s careers is apparent in childhood (Brown & Tam, 2022; Martin & Ruble, 2009). For example, the perception of US 6- to 12-year-olds about whether men or women usually do certain jobs reflected the actual gender breakdown in the fields, with the younger children’s perception being more rigid (Teig & Susskind, 2008).

Additionally, children associate higher status to jobs dominated by men and such stereotype increases with age. US children 6–12 years old assigned higher status (e.g., higher

pay, higher importance, higher difficulty) to traditionally masculine jobs (e.g., doctor, professor) than to feminine jobs (e.g., nurse, teacher), especially in the older children (Liben et al., 2001). Only 15.4% of feminine occupations were rated by elementary school children as high in status, compared to 27.8% of masculine occupations and 47.8% of gender-neutral occupations (Teig & Susskind, 2008). Consistently, US children aged 6–11 years associated power and/or money, arguably the job attributes usually taken to indicate career success, to masculine occupations while they associated altruism with feminine occupations, more so as age increased (Hayes et al., 2018). These occupational gender stereotypes are reflected in children’s own preferences for jobs that are usually held by people of their gender (Liben et al., 2001; Teig & Susskind, 2008) and early elementary boys already prefer jobs depicted as making more money (Hayes et al., 2018).

### Gender Differences at School

Less concern has been raised in areas that show advantages by girls/women but addressing areas in which boys lag behind is also important (Browne, 2013). A meta-analysis showed that girls obtained better school grades and subjective ratings by teachers, not only in language but also math and science (Voyer & Voyer, 2014). Despite small effect sizes, the female advantage was present from primary school to college, stable in the past century and significant in and outside US and Europe (Voyer & Voyer, 2014). Girls’ better performance at school extends beyond marks. Across continents, boys are less engaged at school affectively, behaviorally and cognitively (Lam et al., 2012). Boys are also more likely to have poorer conduct, drop out, and be expelled from school (Somers, 2000; Tire, 2008), gaps that enlarge with age (Tire, 2008).

### Children’s Academic Stereotypes

Both boys and girls tend to think boys are more intelligent and believe in subject-specific male and female superiorities (Bian et al., 2017; Kurtz-Costes et al., 2014). However, a different picture emerged when it comes to judging who is generally a better, more high-achieving student at school. Hartley and Sutton (2013) examined both personal academic gender stereotypes and academic gender meta-stereotypes (perception of others’ stereotypical beliefs) of school performance in British children aged 4–10 years. Children were asked to choose whether a boy or a girl silhouette fitted broad descriptions of student attributes that have been recognized in the educational literature as desirable academic criteria (e.g., performs really well at school; always finishes their work; sits quietly while waiting for their name to be called out). Girls as young as 4 years old and boys from 7 years old believed that girls are better students than boys. Also, girls

and boys from age 4 years already thought adults held the same belief. The gender stereotypes in this study included both personal regard (personal attitudes or beliefs) and public regard (perception of others' attitudes and beliefs). Both types of academic gender stereotypes were stronger, but also less strongly associated with each other, in older than younger children. These developmental findings of personal and meta-stereotypes are consistent with children's increasing awareness of stereotypes others hold (McKown & Strambler, 2009) and increasing theory of mind abilities such as the abilities to infer the mental states of others and to understand that others can have beliefs different from one's own (Wellman et al., 2001).

### Coherence of Stereotypes

The empirical findings on gender-typed outcomes and gender stereotypes reviewed are consistent with predictions of stereotype theories. For example, gender schema theory stipulates that children acquire gender stereotypes and act accordingly once they have established gender identity or gender labeling ability (Cook et al., 2022; Martin & Halverson, 1981). With increasing cognitive capability and cumulative socialization experience, stereotype knowledge (descriptive stereotypes) increases with age. Schema-consistent information is more attended to and remembered better while schema-inconsistent information is more likely to be ignored and distorted. Thus stereotypes, once consolidated, are hard to change and self-reinforcing. Whether endorsement of stereotypes increases with age is unclear. Older children's cognitive capacity allows them to be more flexible (i.e., cognitively recognizing the possibility that both males and females CAN and DO perform certain things), but older children have also been found to be less affectively positive about gender non-conforming peers (Kwan et al., 2020).

Much less is known about the coherence of stereotypes of different content domains. Gender-typing has been proposed as a multidimensional matrix containing different constructs (e.g., concepts/beliefs, behaviors, identity/self-perception) and different contents (e.g., biological sex, activities, interests) (Ruble et al., 2006). Although studies have investigated the relationship between gender-typed cognitions and behaviors, most studies focused on one specific content, such as academic performance (e.g., Hartley & Sutton, 2013) or occupations (e.g., Liben et al., 2001; Teig & Susskind, 2008). Little is known about how stereotypes differing in content domain are related. More specifically, no study examined both academic stereotypes and career stereotypes about which gender is the prototypical successful member.

A few work may be relevant to stereotypes across domains. Children employ stereotypes in different content domains when evaluating different targets. US preschool children, especially older ones, used more stereotypes about

appearance to describe girls (e.g., "girls wear dresses") but more stereotypes about traits or activities and toys to describe boys (e.g., "boys are mean," "boys play with trucks") (Miller et al., 2009). When asked to predict another child's preferences in different content domains (traits, appearance, toys, occupations), 6- to 10-year-olds generalized from their knowledge about one domain to other domains and older children made more stereotypic judgments (Martin et al., 1990). Bian et al. (2017) found that 6- and 7-year-old but not 5-year-old girls were less likely than boys to believe their own gender is intelligent. Interestingly, the older girls were actually more likely than peer boys to perceive their own gender as having better school grades; girls' perception of school achievement and perception of intelligence did not correlate, but the non-significant correlation may be due to small sample size. Overall, the limited body of work suggested that stereotypes are multidimensional, contrasting stereotypes about own gender and another gender can coexist, and may have different developmental patterns in boys and girls.

In the component model (Deaux & Lewis, 1984), gender stereotypes are conceptualized as a set of relatively independent components, but knowledge about one component (e.g., a person who likes playing with barbie) can implicate other components (e.g., the person likely has more female than male friends), because gender information available in the environment allows one to draw inferences to other sets of characteristics. As the inferences may occur in sequence beginning most strongly with more salient and self-relevant ones followed by more abstract and less self-relevant ones, stereotypes about different components may emerge at different ages. Therefore, girls may develop academic gender stereotypes before career gender stereotypes and vice versa for boys, because boys and girls may be more ready to acquire stereotypes about the content area more strongly associated with their gender (e.g., Hartley & Sutton, 2013). How the two stereotypes correlate is more arguable. For example, if children recognize that academic success predicts career success, then stronger stereotyping about female-superior academic success may correlate with weaker stereotyping about male-superior career success. However, if, by the principle of gender schematicity in the gender schema theory, some people are generally chronically more likely to attend to gender information and endorse stereotypes (Bem, 1981; Cook et al., 2022; Martin & Halverson, 1981), then people who believe in female superiority in academic success would also hold stronger belief in male superiority in career success.

### Impact of Academic and Career Gender Stereotypes

Stereotypes may have long term implications via a self-fulfilling prophecy (Andrews et al., 2022; Bian, 2022; Ellemers, 2018; Martin & Ruble, 2009). For example, consistent with stereotype threat theory, telling children that girls

outperform boys on cognitive tests led boys to perform significantly worse compared to when they were told boys and girls don't differ, presumably because the awareness of a stereotype unfavorable to one's gender causes anxiety that interferes with performance (Hartley & Sutton, 2013). Also, consistent with the expectancy-value theory of motivation (Eccles & Wigfield, 2002), the more strongly boys associated school-related concepts (e.g., actively engaging in lesson) with females and negative masculine traits (e.g., aggressive) with themselves, the worse their language grades (Heyder & Kessels, 2013).

Children's stereotypes about school may also be related to their school engagement. People tend to be more interested in activities that they believe to fit their gender (Bian, 2022; Martin & Halverson, 1981). Additionally, as the expectancy-value theory (Eccles & Wigfield, 2002) suggests, increased interest and expectations of success lead to increased engagement and motivation to excel. Indeed, across cultures, school engagement, which is higher in girls, positively correlates with academic performance (Lam et al., 2012).

Likewise, believing that boys will be more successful at work may demotivate girls' career pursuits (Bian, 2022; Ellemers, 2018). For example, women who believed that their choices of occupation did not fit with gender stereotypes reported lower job commitment (Peters et al., 2012). Moreover, children's self-efficacy and stereotyping of STEM careers and communal occupations were associated with their career choice or aspirations (Bandura et al., 2001; Olsen et al., 2022). These findings suggest that, in children, gender stereotypes about academic and career success are related to school grades, school engagement, and career-related motivation, and may moderate the gender differences in these outcomes.

## This Study

We sought to understand the age and gender differences in both academic and career gender stereotypes and their relations to several developmental outcomes. We focused on the primary school stage because it is a critical stage for educational intervention, and children of this age hold stereotypes about school performance and occupations and begin socialization processes with peers and adults in an institutionalized environment (Bian, 2022; Bian et al., 2017; Brown & Tam, 2022; Hartley & Sutton, 2013; Hayes et al., 2018; Liben et al., 2001; Martin & Ruble, 2009).

The first and second aims were to understand the differences concerning gender and age on the gender stereotypes and on other developmental outcomes that have been gender-typed, including school engagement (Lam et al., 2012), school grades (Voyer & Voyer, 2014), and career motivation (Bian, 2022; Ellemers, 2018). Regarding gender differences (Hypothesis 1) and age differences (Hypothesis

2), we hypothesized that (1a) children would perceive girls as better students than boys but (1b) men as more successful than women at work, (2a) that these gender stereotypes would be larger at older ages as older children have weaker tendency to favor their own gender and learn more about stereotypes (Aboud, 1988; Hartley & Sutton, 2013), and (2b) that academic gender stereotypes would be found at earlier ages than career gender stereotypes in girls but vice versa in boys (Deaux & Lewis, 1984; Hartley & Sutton, 2013). We also hypothesized that girls would score higher on (1c) school engagement and (1d) exams and (1e) lower on career-related motivation, and (2c) explored whether these gender differences enlarged with age.

The third aim was to investigate the relationship between different stereotypes (Hypothesis 3). Based on the component model (Deaux & Lewis, 1984) and prior studies on associations between stereotypes within/across domains (Hartley & Sutton, 2013; Martin et al., 1990; Miller et al., 2009), we hypothesized that (3a) academic gender stereotypes would be associated positively with academic gender meta-stereotypes. Also, (3b) academic gender stereotypes would correlate with career gender stereotypes. Children who believed girls are better students would be more likely to believe that men are more successful at work as implicated by gender schematicity, or chronic awareness of gender differences observed in society and socialization messages (Bem, 1981; Martin & Halverson, 1981). We also explored the developmental trend of the association between academic and career gender stereotypes.

The fourth aim was to examine how academic and career gender stereotypes were associated with the developmental outcomes (Hypothesis 4). Building upon prior work that suggested stereotypes contributed to gendered outcomes in academic performance (Andrews et al., 2022; Hartley & Sutton, 2013; Heyder & Kessels, 2013), school engagement and school grades (Gonzalez et al., 2020), and career motivation (Peters et al., 2012), we hypothesized that academic and career gender stereotypes would correlate with and moderate the gender differences in school engagement, exam scores, and career-related motivation such that the gender differences in these outcomes would be larger in the children who held higher levels of the relevant gender stereotype.

Participants were Hong Kong Chinese children. The hypotheses formulated drew upon Western literature and the current findings are reasoned to be generally applicable to other developed cultures. This is because although culture likely plays a role, past literature on gender identity, gender role behavior, gender socialization and gender stereotypes showed similarity in their patterns and theoretical mechanisms across Chinese and Euro-American cultures (Bian, 2022; Gibbons, 2000; Lam et al., 2012; Roberts, 2022; Voyer & Voyer, 2014; Wong & VanderLaan, 2020).

## Method

### Participants

Participants were students in Grades 1–6 from three Hong Kong primary schools located in three districts for which the median household income was respectively the highest, ninth, and lowest among eighteen districts (Census & Statistics Department Hong Kong Special Administrative Region, 2018). The schools were selected to ensure variability in district socioeconomic status and affiliated religion (Christian, Catholic, Taoist) for sample inclusivity. Additionally, they were selected on the basis of being government-aided schools and using Chinese or both Chinese and English as a medium of teaching because these characteristics were representative of typical schools in the region. All students were invited to participate. Questionnaires were administered in each class by a researcher or a class teacher after obtaining parental consent and student assent. For students in Grades 4–6, instructions were explained and students completed the questionnaire on their own. For students in Grades 1–3, questions were read out by a researcher to ensure students' understanding and the students recorded their responses on an answer sheet. Apart from the scale measures, students' latest exam scores of four core subjects (Chinese, Math, English, General Study) were collected from teachers.

Among the 1259 students who participated (participation rate: 67.72%), those who did not indicate their gender ( $n = 2$ ) and those who were repeaters and/or with special education needs ( $n = 113$ ) were excluded. The final sample ( $N = 1144$ ,  $M_{\text{age}} = 9.66$ ,  $SD = 1.87$ ) consisted of 567 boys ( $M_{\text{age}} = 9.00$ ,  $SD = 1.91$ ) and 577 girls ( $M_{\text{age}} = 9.13$ ,  $SD = 1.84$ ). At  $\alpha = .05$ , two tailed, the sample

provides > 92% power to detect small effects in correlations ( $r > 0.10$ ) and small differences between two independent groups ( $d > 0.20$ ), and > 86% power to detect small effects in ANOVAs ( $f > 0.10$ ). Supplementary Table S1 shows sample sizes by gender and grade and Table 1 shows zero-order correlations of study variables.

### Measures

#### Academic Gender Stereotypes

Children were presented with 13 statements and asked to circle either a male or a female child silhouette to indicate whether they thought each description was about a boy or a girl (Hartley & Sutton, 2013). The left–right position of the silhouettes was counterbalanced. Half of the descriptions were presented in positive wordings (e.g., “This child does really well at school,”) and another half in negative wordings (e.g., “This child doesn't know very much,”) counterbalanced across classes in each school. Answers reflecting beliefs in girls' superiority were scored “1” and otherwise “0.” Item scores were averaged and higher scores indicated stronger beliefs in girls' academic superiority ( $\alpha = 0.90$ ). Three additional items asked about specific subjects (Math, Science, Language) and were analyzed individually and presented in Supplementary Figure S1.

#### Academic Gender Meta-Stereotypes

Children's meta-stereotypes about adults' gendered expectations regarding academic behavior and performance were measured by 6 items in the format of “Who do grown-ups think (mostly boys or mostly girls) e.g., “are clever” (Hartley & Sutton, 2013). As on the academic gender stereotypes scale, children indicated their answers by circling the boy

**Table 1** Zero-order correlations of study variables by gender

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Age		.96**	-.07	.02	-.27**	.05	-.23**	.08	.07	.04	.06
2. Grade	.96**		-.05	.01	-.24**	.02	-.23**	.05	.05	.01	.03
3. Academic gender stereotypes	.33**	.31**		.53**	.22**	.13**	.18**	.14*	.10*	.11*	.12*
4. Academic gender meta-stereotypes	.40**	.40**	.69**		.16**	.10*	.12**	.09*	.09*	.07	.06
5. Career gender stereotypes	-.07	-.10*	.09*	.06		.05	.08	-.08	-.06	-.09*	-.11**
6. Career-related motivation for school excellence	.06	.05	.00	-.01	-.01		.30**	.07	.07	.04	.05
7. School engagement	-.23**	-.24**	-.19**	-.21**	.02	.25**		.02	.02	.08	.00
8. Exam-Chinese	-.05	-.06	-.04	.02	-.17**	.05	.09*		.72**	.73**	.77**
9. Exam-English	-.06	-.05	-.05	-.02	-.11**	.09*	.12**	.70**		.69**	.66**
10. Exam-Math	-.01	.00	-.03	.01	-.12**	.08	.09*	.72**	.70**		.67**
11. Exam-General Study	-.04	-.03	-.03	.03	-.12**	.08	.14**	.75**	.66**	.68**	

Coefficients below the diagonal represent correlations for boys; coefficients above the diagonal represent correlations for girls

\* $p < .05$ , \*\* $p < .001$

or girl silhouette. The left–right position of the silhouettes and the wordings of items were counterbalanced. Answers reflecting beliefs in girls’ superiority were scored “1” and otherwise “0.” Item scores were averaged and higher scores indicated stronger belief that adults expected girls’ superiority ( $\alpha = 0.82$ ). Three additional items were subject-specific. They were analyzed individually and presented in Supplementary Figure S1.

### Career Gender Stereotypes

We developed a new measure on general career gender stereotypes to assess students’ gender stereotypes about career outcomes. The new scale shares the same format as the academic gender stereotypes scale. Full items can be found in Appendix A in supplementary materials. Statements were presented and students chose from a male or female adult silhouette, counterbalanced for left–right position and positive or negative wording, to indicate whether they thought each scenario was about a man or a woman. Eight items described attributes that have been associated with career success, such as status, achievement, and hire-ability (e.g., “This person is the boss of a company.” “This person has a prestigious job”). Answers reflecting beliefs in female superiority were scored “1” and otherwise “0.” Higher scores indicated stronger belief in women’s career superiority ( $\alpha = 0.75$ ). Eight additional items asked about specific jobs to provide insight into whether children thought men and women occupy different jobs (i.e., doctor, nurse, professor, primary school teacher, mathematician, technician, scientist, engineer). Answers to these field-specific items were analyzed individually and presented in Supplementary Figure S1.

### Career-Related Motivation for School Excellence

We developed a 6-item scale to measure to what extent children’s motivation for school excellence was career-related. Full items can be found in Appendix B in supplementary materials. Children were asked to rate, using a 5-point scale from 1 (*Not accurate at all*) to 5 (*Very accurate*), how much they agreed with statements about career-related motivation to perform well at school (e.g., “I want to do well at school, so that I can have a successful career”). Item scores were averaged and higher scores indicated stronger career-related motivation for school excellence ( $\alpha = 0.74$ ).

### School Engagement

School engagement was measured with 18 items covering an affective subscale, a behavioral subscale, and a cognitive subscale (Lam et al., 2012, 2014), all rated on 5-point scales from 1 to 5 indicating either level of agreement or level of frequency. Scores were averaged, with higher scores reflecting

higher level of engagement. The full scale correlated highly with the subscales ( $r_s > 0.85$ ), so the full scale ( $\alpha = 0.92$ ) was used in analyses.

### Exam Scores

Students’ latest school exam scores of four core subjects (Chinese, English, Math, and General Study) were collected from the teachers to provide objective indices of academic performance. All participants were subjected to the 100-point scoring system in exams, so the possible raw score range of all subjects was 0–100. To correct for possible differences in difficulty level, Z-scores calculated by school and grade were used in analyses.

## Results

### Children’s Academic and Career Gender Stereotypes (H1a, H1b)

To test the hypotheses that children perceived girls to be better than boys at school (H1a) and men to be more successful than women at work (H1b), we conducted one-sample *t*-tests comparing the group means to the mid-point (0.5) of academic gender stereotypes, academic gender meta-stereotypes, and career gender stereotypes. The mid-point indicates no gender stereotyping and higher scores indicate stronger belief in female superiority (Table 2).

For academic gender stereotypes, girls at all grades believed that girls are the better students. In contrast, findings differed by grade in boys. Boys at Grades 1 and 2 believed in male superiority; boys at Grades 3 and 4 did not show belief in either male or female superiority; boys at Grades 5 and 6 believed in female superiority.

A similar pattern was also found for academic gender meta-stereotypes. Girls at all grades believed that adults would expect girls to be the better students at school. However, boys at the Grades 1 and 2 believed that adults would expect male superiority; boys at Grades 3 and 4 believed adults’ expectation to be similar for boys and girls; while boys at Grades 5 and 6 believed that adults would expect female superiority.

For career gender stereotypes, boys at all grades believed that men are more successful than women at work. In contrast, girls at Grades 1–3 believed that men and women are equally successful at work, whereas girls at Grades 4 and above believed in male superiority.

In sum, H1a was supported in girls of all grades and boys at Grades 5 and above. H1b was supported in boys of all grades and girls at Grades 4 and above.

Children’s gender stereotypes for specific subjects and jobs are shown in Supplementary Figure S1. The majority

**Table 2** One-sample *t*-tests on children's gender stereotypes

Grade	Boys						Girls					
	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>
<i>Academic gender stereotypes</i>												
1	.38	.32	-4.34	126	<.001	-0.38	.83	.20	16.90	102	<.001	1.65
2	.40	.33	-3.00	106	.003	-0.30	.76	.28	9.03	94	<.001	0.93
3	.51	.34	0.30	79	.763	0.03	.84	.22	15.60	101	<.001	1.55
4	.48	.32	-0.55	72	.584	-0.06	.84	.21	14.78	87	<.001	1.62
5	.65	.28	5.05	87	<.001	0.54	.77	.22	11.94	92	<.001	1.23
6	.64	.27	4.77	91	<.001	0.52	.78	.20	13.30	95	<.001	1.40
<i>Academic gender meta-stereotypes</i>												
1	.34	.35	-4.98	126	<.001	-0.46	.82	.25	13.37	102	<.001	1.28
2	.40	.33	-3.17	106	.002	-0.30	.76	.30	8.63	94	<.001	0.87
3	.53	.34	0.70	79	.484	0.09	.80	.25	12.15	101	<.001	1.20
4	.55	.36	1.29	72	.202	0.14	.85	.23	14.10	87	<.001	1.52
5	.72	.31	6.66	87	<.001	0.71	.80	.24	12.08	92	<.001	1.25
6	.70	.27	7.22	91	<.001	0.74	.81	.22	13.50	95	<.001	1.41
<i>Career gender stereotypes</i>												
1	.31	.24	-9.04	126	<.001	-0.79	.51	.30	0.34	102	.736	0.03
2	.24	.19	-14.25	106	<.001	-1.37	.50	.34	-0.05	94	.957	0.00
3	.24	.19	-12.30	79	<.001	-1.37	.48	.31	-0.56	101	.576	-0.06
4	.27	.24	-8.44	72	<.001	-0.96	.42	.29	-2.46	87	.016	-0.28
5	.22	.23	-11.09	87	<.001	-1.22	.35	.26	-5.72	92	<.001	-0.58
6	.23	.25	-10.17	91	<.001	-1.08	.32	.25	-7.32	95	<.001	-0.72

Test value of the one-sample *t*-tests is .50, which is the mid-point of the possible range (0–1) of the scale scores. Scores below .50 indicate stereotypes favoring boys/men; scores above .50 indicate stereotypes favoring girls/women

of the children believed that a child who is good at science (56%) or math (58%) or thought by adults to be good at science (61%) or math (64%) is a boy, while a child who is good at Chinese and English (63%) or thought by adults to be good at Chinese and English (63%) is a girl. Considerable percentages of children believed that a person who is an engineer (88%), doctor (83%), professor (80%), scientist (73%), technician (64%), or mathematician (56%) is a man, while a person who is a nurse (93%) or primary school teacher (81%) is a woman.

### Gender and Age Differences in Gender Stereotypes and School Outcomes (H1c,d,e and H2)

Because the descriptive statistics and one-sample *t*-tests showed that differences in patterns roughly corresponded to Grades 1 to 2, 3 to 4, and 5 to 6, we grouped children into three grade groups in the following analyses for parsimony. We conducted a series of 2 (Gender: boys, girls) × 3 (Grade: 1–2, 3–4, 5–6) ANOVAs on each outcome variable. For any significant interaction between gender and grade, follow-up tests were conducted by splitting gender to compare the three age groups in each gender and by splitting grade

to compare the two gender groups in each grade. Post hoc pairwise comparisons were Bonferroni adjusted. Detailed statistics are shown in Table 3. Estimated marginal means are shown in Supplementary Table S2. For all gender stereotype measures, higher scores indicated a stronger belief in female superiority.

### Academic Gender Stereotypes

There was a main effect of gender (girls scored higher). There were also a main effect of grade and an interaction effect between gender and grade. The follow-up tests splitting grades showed that for all three age groups, girls reported stronger belief than boys in female academic superiority. When tested by splitting gender, there were significant age differences in both boys and girls. Boys at Grades 5 to 6 had the strongest belief in female academic superiority, followed by those at Grades 3 to 4, and boys at Grades 1 to 2 reported the weakest of such belief. In contrast, girls at Grades 5 to 6 had the weakest belief in female academic superiority, while girls at Grades 1 to 2 did not differ from those at Grades 3 to 4.

**Table 3** Results of 2 (Gender: boys, girls) × 3 (Grade: 1–2, 3–4, 5–6) ANOVAs on the outcome variables

Dependent variable	Main effect of gender	Main effect of grade	Gender × Grade interaction
Academic gender stereotypes	Boys < Girls $F(1, 1138) = 330.29$ $p < .001$ $d = -0.95$	$F(2, 1138) = 18.77$ $p < .001$ Pairwise comparisons: Grades 1–2 < Grades 3–4 ( $p < .001$ , $d = -0.32$ ) Grades 1–2 < Grades 5–6 ( $p < .001$ , $d = -0.44$ ) Grades 3–4 ≈ Grades 5–6 ( $p = .630$ , $d = -0.09$ )	$F(2, 1138) = 27.17$ $p < .001$ Split gender Boys: $p < .001$ Grades 1–2 < Grades 3–4 ( $p = .003$ , $d = -0.33$ ) Grades 1–2 < Grades 5–6 ( $p < .001$ , $d = -0.85$ ) Grades 3–4 < Grades 5–6 ( $p < .001$ , $d = -0.49$ ) Girls: $p = .024$ Grades 1–2 ≈ Grades 3–4 ( $p = .232$ , $d = -0.18$ ) Grades 1–2 ≈ Grades 5–6 ( $p > .999$ , $d = 0.10$ ) Grades 3–4 > Grades 5–6 ( $p = .021$ , $d = 0.29$ ) Split grade Grades 1–2: Boys < Girls ( $p < .001$ , $d = -1.44$ ) Grades 3–4: Boys < Girls ( $p < .001$ , $d = -1.25$ ) Grades 5–6: Boys < Girls ( $p < .001$ , $d = -0.54$ )
Academic gender meta-stereotypes	Boys < Girls $F(1, 1138) = 234.57$ $p < .001$ $d = -0.83$	$F(2, 1138) = 36.37$ $p < .001$ Pairwise comparisons: Grades 1–2 < Grades 3–4 ( $p < .001$ , $d = -0.37$ ) Grades 1–2 < Grades 5–6 ( $p < .001$ , $d = -0.61$ ) Grades 3–4 < Grades 5–6 ( $p = .010$ , $d = -0.22$ )	$F(2, 1138) = 32.24$ $p < .001$ Split gender Boys: $p < .001$ Grades 1–2 < Grades 3–4 ( $p < .001$ , $d = -0.49$ ) Grades 1–2 < Grades 5–6 ( $p < .001$ , $d = -1.08$ ) Grades 3–4 < Grades 5–6 ( $p < .001$ , $d = -0.53$ ) Girls: ns ( $p = .621$ ) Split grade Grades 1–2: Boys < Girls ( $p < .001$ , $d = -1.39$ ) Grades 3–4: Boys < Girls ( $p < .001$ , $d = -0.94$ ) Grades 5–6: Boys < Girls ( $p = .001$ , $d = -0.36$ )
Career gender stereotypes	Boys < Girls $F(1, 1138) = 128.63$ $p < .001$ $d = -0.63$	$F(2, 1138) = 18.08$ $p < .001$ Pairwise comparisons: Grades 1–2 ≈ Grades 3–4 ( $p > .999$ , $d = 0.05$ ) Grades 1–2 > Grades 5–6 ( $p < .001$ , $d = 0.37$ ) Grades 3–4 > Grades 5–6 ( $p < .001$ , $d = 0.31$ )	$F(2, 1138) = 6.23$ $p = .002$ Split gender Boys: ns ( $p = .105$ ) Girls: $p < .001$ Grades 1–2 ≈ Grades 3–4 ( $p = .301$ , $d = 0.16$ ) Grades 1–2 > Grades 5–6 ( $p < .001$ , $d = 0.61$ ) Grades 3–4 > Grades 5–6 ( $p < .001$ , $d = 0.45$ ) Split grade Grades 1–2: Boys < Girls ( $p < .001$ , $d = -0.84$ ) Grades 3–4: Boys < Girls ( $p < .001$ , $d = -0.78$ ) Grades 5–6: Boys < Girls ( $p < .001$ , $d = -0.41$ )

**Table 3** (continued)

Dependent variable	Main effect of gender	Main effect of grade	Gender × Grade interaction
Career-related motivation for school excellence	Boys > Girls $F(1, 1138) = 5.53$ $p = .019$ $d = 0.14$	ns $F(2, 1138) = 1.37$ $p = .254$	ns $F(2, 1138) = 0.80$ $p = .448$
School engagement	Boys < Girls $F(1, 1138) = 4.71$ $p = .030$ $d = -0.10$	$F(2, 1138) = 37.00$ $p < .001$ Pairwise comparisons: Grades 1–2 > Grades 3–4 ( $p < .001$ , $d = 0.33$ ) Grades 1–2 > Grades 5–6 ( $p < .001$ , $d = 0.60$ ) Grades 3–4 > Grades 5–6 ( $p = .001$ , $d = 0.27$ )	ns $F(2, 1138) = 0.15$ $p = .865$
Exam-Chinese	Boys < Girls $F(1, 1138) = 6.95$ $p = .008$ $d = -0.15$	ns $F(2, 1138) = 0.01$ $p = .995$	ns $F(2, 1138) = 2.36$ $p = .095$
Exam-English	ns $F(1, 1138) = 2.87$ $p = .091$ $d = -0.10$	ns $F(2, 1138) = 0.00$ $p = .999$	$F(2, 1138) = 3.51$ $p = .030$ Split gender Boys: ns ( $p = .186$ ) Girls: ns ( $p = .159$ ) Split grade Grades 1–2: ns ( $p = .710$ , $d = 0.04$ ) Grades 3–4: ns ( $p = .867$ , $d = -0.02$ ) Grades 5–6: Boys < Girls ( $p = .002$ , $d = -0.32$ )
Exam-Math	Boys > Girls $F(1, 1138) = 14.49$ $p < .001$ $d = 0.22$	ns $F(2, 1138) = 0.07$ $p = .936$	ns $F(2, 1138) = 0.76$ $p = .469$
Exam-General Study	ns $F(1, 1138) = 0.00$ $p = .954$ $d = 0.00$	ns $F(2, 1138) = 0.00$ $p = .996$	ns $F(2, 1138) = 1.16$ $p = .314$

Bonferroni adjustment was adopted in the follow-up tests for the significant main effects of grade and the significant interaction effects  
*ns* not significant at  $p < .05$  level

### Academic Gender Meta-Stereotypes

There was a main effect of gender (girls scored higher). There were also a main effect of grade and an interaction between gender and grade. The follow-up tests showed that for all three age groups, girls had a stronger belief than boys that adults would think girls are better students at school. There were significant age differences in boys but not girls. Boys at Grades 5 to 6 reported the strongest meta-stereotypes in female superiority, followed by those at Grades 3 to 4, and boys at Grades 1 to 2 reported the weakest meta-stereotypes. In contrast, no significant age difference was found in girls.

### Career Gender Stereotypes

There was a main effect of gender (girls scored higher). There were also a main effect of grade and an interaction

effect between gender and grade. The follow-up tests splitting grades showed that for all three age groups, girls reported a weaker belief than boys in male superiority in career success. When splitting gender, there were significant age differences in girls but not boys. Girls at Grades 5 to 6 reported the strongest belief in male superiority than did younger girls, with no difference between girls at Grades 1 to 2 and Grades 3 to 4.

### Career-Related Motivation for School Excellence

There was a significant main effect of gender (boys scored higher than girls). No significant main effect of grade or interaction between gender and grade was found.

## School Engagement

There was a significant main effect of gender (girls scored higher than boys). There was also a main effect of grade (school engagement declined with age). Children at Grades 1 to 2 reported the highest school engagement, followed by children at Grades 3 to 4 and Grades 5 to 6. No significant interaction between gender and grade was found.

## Exam Scores

There were main effects of gender in exam scores of Chinese and Math, but not English or General Study. Girls performed better than boys in Chinese, while boys performed better than girls in Math. There was also a significant interaction between gender and grade in English. Girls performed better than boys at Grades 5 to 6 but no significant gender difference was found at Grades 1 to 2 and Grades 3 to 4. There was no effect of grade which was expected due to the standardization of exam scores within each grade.

## Relationship Between Academic and Career Gender Stereotypes (H3)

The relationship between different stereotypes was tested by hierarchical linear regressions adapted from Hartley and Sutton's (2013) approach. In one regression, exam scores were first entered as control variables, and Grade (in three groups: 1–2, 3–4, 5–6), Academic gender stereotypes, and Grade  $\times$  Academic gender stereotypes were entered as predictors of career gender stereotypes. In a separate regression, the same model was conducted with Academic gender meta-stereotypes (what gender stereotypes children thought adults would hold) replacing Academic gender stereotypes. Academic gender stereotypes and meta-stereotypes were mean-centered. Because adding gender and gender-involved interaction terms to the model caused multicollinearity problems, we also computed the regressions in boys and girls separately.

For boys, the interactions between grade and academic stereotypes were not significant for academic gender stereotypes,  $\beta = 0.13$ ,  $t(566) = 1.30$ ,  $p = .193$ , or for academic gender meta-stereotypes,  $\beta = 0.02$ ,  $t(566) = 0.21$ ,  $p = .835$ , suggesting that there was no significant difference in the association between academic and career stereotypes among boys in different grades. The overall regression coefficient of the relation between academic gender stereotypes and career gender stereotypes was  $\beta = 0.08$ ,  $t(566) = 1.99$ ,  $p = .047$ , and that between academic meta-gender stereotypes and career gender stereotypes was  $\beta = 0.07$ ,  $t(566) = 1.56$ ,  $p = .120$ .

For girls, both interactions were significant for academic gender stereotypes,  $\beta = -0.32$ ,  $t(576) = -3.15$ ,  $p = .002$ , and for academic gender meta-stereotypes,  $\beta = -0.47$ ,  $t(576) = -4.73$ ,  $p < .001$ , such that academic gender

stereotypes were more dissociated from career gender stereotypes in girls of higher grades. The regression coefficients of the relation between academic gender stereotypes and career gender stereotypes were  $\beta = 0.40$ ,  $t(197) = 5.98$ ,  $p < .001$  for Grades 1 to 2,  $\beta = 0.17$ ,  $t(189) = 2.23$ ,  $p = .027$  for Grades 3 to 4, and  $\beta = 0.10$ ,  $t(188) = 1.30$ ,  $p = .196$  for Grades 5 to 6. The regression coefficients between academic meta-gender stereotypes and career gender stereotypes were  $\beta = 0.43$ ,  $t(197) = 6.57$ ,  $p < .001$  for Grades 1 to 2,  $\beta = 0.05$ ,  $t(189) = 0.62$ ,  $p = .539$  for Grades 3 to 4, and  $\beta = -0.03$ ,  $t(188) = -0.46$ ,  $p = .644$  for Grades 5 to 6.

To further examine the developmental trend of the association between academic and career gender stereotypes, we also report partial correlations between academic and career gender stereotypes controlling for exam scores as an alternative analysis in Supplementary materials (pp. 1–2). The correlations provided converging evidence to the hierarchical linear regressions, showing that the gender that was believed to be superior in academic and career gender stereotypes was more dissociated in older than young girls.

## Moderating Role of Gender Stereotypes (H4)

To investigate whether and how the gender differences in school engagement, exam scores, and career-related motivation differed by level of gender stereotypes (i.e., whether gender stereotypes moderated the gender differences), a series of moderation analysis were conducted using the SPSS macro PROCESS single moderator model (Hayes, 2017, 2019). Academic gender stereotypes or meta-stereotypes were tested as the moderator of the academic outcomes (school engagement, exam scores), and career gender stereotypes were tested as the moderator of career-related motivation. Grade was controlled for all outcome variables; grade and exam scores were controlled for when school engagement was the outcome variable. Results of the moderations are summarized in Table 4. Significant moderation effects were found in academic gender stereotypes and academic gender meta-stereotypes but not in career gender stereotypes. Post hoc tests probed the moderation effect at the low (mean – 1SD), average (mean), and high (mean + 1SD) levels of gender stereotypes (see Fig. 1 for significant moderation effects and Supplementary Figure S3 for non-significant moderation effects).

Academic gender stereotypes and academic gender meta-stereotypes moderated the gender difference in school engagement. Significant gender differences in opposite directions were found at the low and high levels of academic gender stereotypes. For students with low levels of academic gender stereotypes and academic gender meta-stereotypes (i.e., weaker belief in female superiority), boys showed stronger engagement than girls; whereas for those with high levels of academic gender stereotypes and academic gender

**Table 4** Moderation effects of academic and career gender stereotypes on school outcomes

Dependent variable	Moderation effects		
	Gender × Academic gender stereotypes	Gender × Academic gender meta-stereotypes	Gender × Career gender stereotypes
School engagement	$F(1, 1135) = 24.77$ $p < .001$ Mean – 1SD: $p = .017$ , Boys > Girls Mean: $p = .144$ , ns Mean + 1SD: $p < .001$ , Boys < Girls	$F(1, 1135) = 17.67$ $p < .001$ Mean – 1SD: $p = .117$ , ns Mean: $p = .050$ , ns Mean + 1SD: $p < .001$ , Boys < Girls	NA
Exam-Chinese	$F(1, 1139) = 10.19$ $p = .001$ Mean – 1SD: $p = .148$ , ns Mean: $p = .264$ , ns Mean + 1SD: $p < .001$ , Boys < Girls	$F(1, 1139) = 1.93$ $p = .165$ ns	NA
Exam-English	$F(1, 1139) = 6.71$ $p = .010$ Mean – 1SD: $p = .210$ , ns Mean: $p = .434$ , ns Mean + 1SD: $p = .008$ , Boys < Girls	$F(1, 1139) = 3.89$ $p = .049$ Mean – 1SD: $p = .414$ , ns Mean: $p = .407$ , ns Mean + 1SD: $p = .031$ , Boys < Girls	NA
Exam-Math	$F(1, 1139) = 6.96$ $p = .008$ Mean – 1SD: $p < .001$ , Boys > Girls Mean: $p < .001$ , Boys > Girls Mean + 1SD: $p = .313$ , ns	$F(1, 1139) = 1.45$ $p = .229$ ns	NA
Exam-General Study	$F(1, 1139) = 7.59$ $p = .006$ Mean – 1SD: $p = .013$ , Boys > Girls Mean: $p = .323$ , ns Mean + 1SD: $p = .144$ , ns	$F(1, 1138) = 0.44$ $p = .506$ ns	NA
Career-related motivation for school excellence	NA	NA	$F(1, 1139) = 0.82$ $p = .365$ ns

NA—not applicable

ns—not significant at  $p < .05$  level

meta-stereotypes, girls showed stronger engagement than boys.

Academic gender stereotypes also moderated the gender differences in exam scores of Chinese, English, Math, and General Study. For Chinese and English, girls performed better than boys only when academic gender stereotypes were high. For Math, boys performed better than girls when academic gender stereotypes were low and average but there was no gender difference when academic gender stereotypes were high. For General Study, boys performed better than girls when academic gender stereotypes were low but there was no gender difference when academic gender stereotypes were average or high. Academic gender meta-stereotypes moderated the gender differences in English exam score only, with girls performing better than boys only when academic gender meta-stereotypes were high.

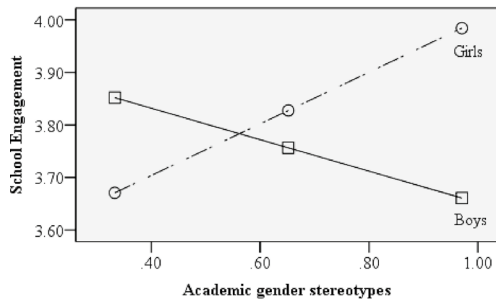
Career gender stereotypes did not moderate the gender difference in career-related motivation. At all levels of career gender stereotypes, boys showed higher career-related

motivation than girls at similar effect sizes, as shown in panel (d) of Supplementary Figure S3.

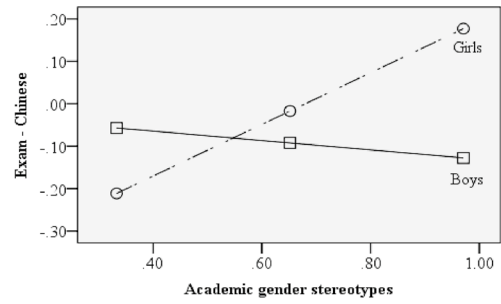
## Discussion

Both school performance and career achievement have been reported to show gender differences and stereotypes. This study addressed the paucity of research that investigated stereotypes in these domains simultaneously. We investigated children's beliefs about how well each gender performs in the academic and career domains in a large sample of primary school students. Apart from developmental differences in these stereotypes, we investigated whether gender differences in important indicators of school performance depended on the levels of these stereotypes. These descriptive stereotypes are believed to develop early and become prescriptive as people have the tendency to believe what "is" as what "should be," which in turn maintains the status quo (Koenig, 2018;

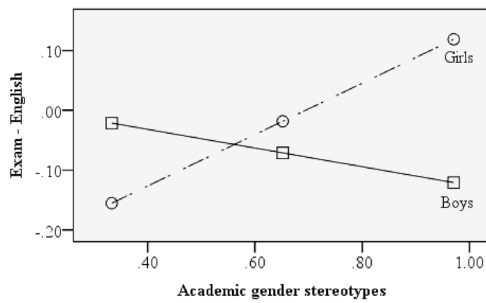
(a) Moderator = Academic gender stereotypes, DV = School engagement



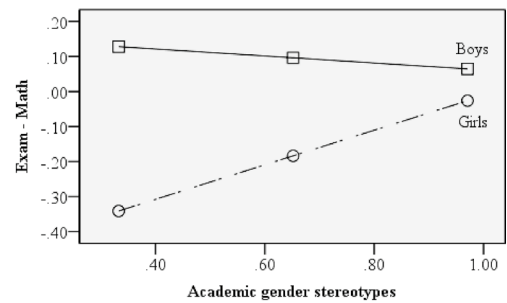
(b) Moderator = Academic gender stereotypes, DV = Exam-Chinese



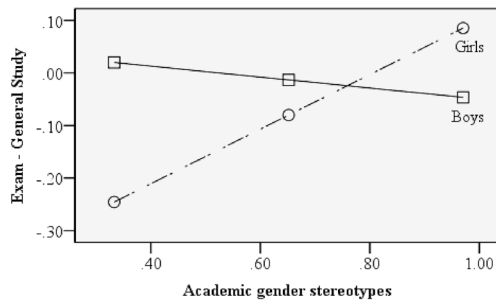
(c) Moderator = Academic gender stereotypes, DV = Exam-English



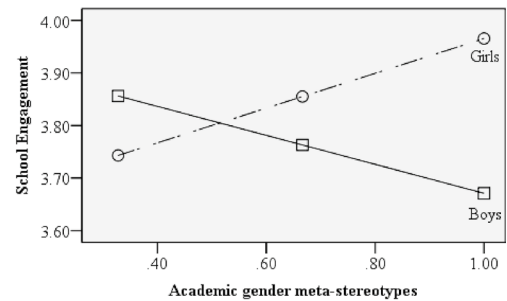
(d) Moderator = Academic gender stereotypes, DV = Exam-Math



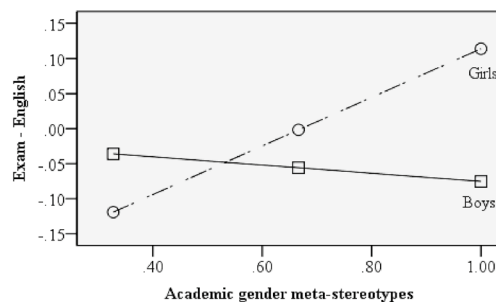
(e) Moderator = Academic gender stereotypes, DV = Exam-General Study



(f) Moderator = Academic gender meta-stereotypes, DV = School engagement



(g) Moderator = Academic gender meta-stereotypes, DV = Exam-English



**Fig. 1** Significant moderation effects by gender stereotypes. Academic gender stereotypes significantly moderated the gender difference in school engagement (a), and exam scores in Chinese (b), English (c), Math (d), and General Study (e). Academic gender meta-stereotypes significantly moderated the gender difference in school engagement (f) and English exam scores (g). Academic gender meta-stereotypes did not significantly moderate gender differences in exam scores in Chinese, Math, and General Study, and career gender stereotypes did not significantly moderate the gender difference in career-related motivation for school excellence (see Figure S3)

Roberts, 2022). The descriptive-to-prescriptive reasoning tendency is particularly strong in young children who may have an undifferentiated concept of normality and has been found in both US and Chinese adults and children (Roberts, 2022). Gender stereotypes may lead to real-life impacts because perceiving certain fields or positions as other-gender-typed may lower sense of belonging and goal-setting and reduce self-efficacy (Andrews et al., 2022; Bian, 2022; Ellemers, 2018; Martin & Ruble, 2009). It is thus important to study stereotype beliefs in young children.

### The Development of Academic and Career Gender Stereotypes

Comparing scores on the academic gender stereotypes and meta-stereotypes scales and a newly developed career gender stereotypes scale, we found that children held both positive and negative stereotypes about boys/men and girls/women, and both academic and career stereotypes are present in middle childhood. During the primary school years, children acquire stereotypes that are consistent with the actual gender differences in academic and career achievements found in the literature (Bian, 2022; Bian et al., 2017; Brown & Tam, 2022; Ellemers, 2018; Hartley & Sutton, 2013; Kurtz-Costes et al., 2014; Liben et al., 2001; Martin & Ruble, 2009; Teig & Susskind, 2008). The children showed subject- and job-specific stereotypes consistent with prior literature, favoring men and boys on STEM and high-status/agentive items and women and girls on language items and lower status/nurturance items. We focus on perceptions of general success and achievement. In the current study, girls in all grades believed that girls are better students with very large effect sizes (*ds* between 0.93 and 1.65). Boys in lower grades believed boys are better students, but this belief was replaced by the opposite belief in boys at higher grades, albeit with smaller effect sizes (*ds* between 0.52 and 0.54). Children's meta-stereotypes of adults were highly similar to their own stereotypes, thus academic gender stereotypes and academic gender meta-stereotypes correlated highly and the developmental pattern of these two stereotypes closely resembled each other. These findings resonate with findings that US girls from age 4 years and boys from age 7 years believed, and thought

adults believed, that girls are better students than boys at school (Hartley & Sutton, 2013).

Prior research found that children in middle childhood, especially the older ones, assigned higher status to masculine jobs (Liben et al., 2001; Teig & Susskind, 2008) and job attributes that traditionally indicate status or success (money, power) are more associated with masculine jobs and preferred more by boys than girls (Hayes et al., 2018). We assessed whether children thought a person described with superior career success and status is a man or woman. Consistent with past findings on perceptions of masculine versus feminine jobs and in sharp contrast to findings on academic stereotypes, boys at all grades believed that men are more successful than women at work with large effect sizes (*ds* from  $-0.79$  to  $-1.37$ ). In contrast, younger girls did not differentiate men and women in this likelihood and girls at Grades 4 or above believed in male superiority at work.

The developmental patterns of the stereotypes appear to reflect young children's initial ingroup favoritism which entails naive beliefs that assign desirable qualities to their own gender (Aboud, 1988; Hartley & Sutton, 2013; Yee & Brown, 1994) such that in the lower grades, boys and girls believed their own gender were better students and more successful workers. Boys were slower to learn about the female superiority at school and girls were slower about the male superiority at work, perhaps owing to the fact that children tend to acquire stereotypes which are more self-relevant, and these are likely stereotypes about domains that favor or are strongly associated with their own gender (Deaux & Lewis, 1984). The increasing knowledge of gender stereotypes may be acquired by cumulative social feedback (e.g., teachers rewarding girls for more in class) and observation of models (e.g., seeing more male models in high-status jobs) (Blakemore et al., 2009). The increased stereotype knowledge also reflects internalization of adults' expectations supported by increasing perspective-taking ability (Hartley & Sutton, 2013; Wellman et al., 2001) and shown by the positive correlations between academic gender stereotypes and meta-stereotypes. These social-cognitive sources of socialization may increasingly align children's expectations with real world statistics and adult expectations.

### Within-Person Association Between Academic and Career Gender Stereotypes

The finding that the gender to which the two stereotype domains favored was different is interesting given how strong doing well at school predicts successful careers (Kell et al., 2013). Including academic gender stereotypes and career gender stereotypes simultaneously allowed direct investigation into whether perception of success in these domains was indeed disconnected. Regardless of the analytic approach, the evidence converged to show weaker associations between

academic and career gender stereotypes in older children, and in fact some results showed that in the oldest children at the end of primary school, the association was not significant, unlike in the younger children in which the association was positive. The positive association in the younger children could reflect their ingroup bias and/or awareness that studying well lays the foundations for a good career. However, the older the children, the less likely they were to believe that the gender group that studies well at school also is the group that is likely to be successful at work.

We did not find a correlation between belief in female academic superiority and belief in male career superiority, which would be predicted by gender schematicity (Bem, 1981; Martin & Halverson, 1981). However, the declining associations in belief in female superiority across the two domains can indicate an emerging trend of gender schematicity which may become more apparent if older participants were included. The non-association between the two stereotypes is of sufficient concern, as it suggested that at the end of primary school, both boys and girls tended not to believe that whoever studied and behaved better at school would also be more successful at work. This finding coincides with a smaller study on intelligence, which found that 6- and 7-year-old girls were less likely than boys to believe their own gender is intelligent and their perceptions of school achievements and perception of intelligence did not correlate, despite that they were actually more likely than peer boys to perceive their own gender as having better school grades (Bian et al., 2017). The career-related motivation scale showed that boys' academic pursuit was more career-motivated. To the extent that career prospects motivate academic pursuit and career building, it would be worthwhile to investigate further why the perceptions of success in academic and career domains was increasingly disconnected in older children and how this relates to career ambition and paths later in life.

### Gender Differences are Moderated by Gender Stereotypes

The selected age-appropriate developmental outcomes including school engagement, exam scores and career-related motivation showed expected gender differences, with girls scoring higher in school engagement and feminine-stereotyped subjects (Chinese and English) and boys scoring higher in career-related motivation and a masculine-stereotyped subject (Math). The role that gender stereotypes played in these outcomes was not that of a direct predictor variable (indicated by the minimal zero-order correlations in Table 1), but that of a moderator, meaning that the magnitude or direction of the gender differences in the other variables depended on the level of gender stereotypes the children held. We tested moderation effects that were domain-specific. Career gender stereotypes were not related to the effect of gender on

career-related motivation for school excellence. Perhaps this shows that children did not yet strongly associate study motivations with career prospects. Future studies should test other career variables such as career ambition and occupational values. Moderation effects by academic gender stereotypes on school engagement and all exam scores were apparent. Boys and girls differed more on these outcomes if they had higher levels of the stereotypes, suggesting that relying on the correlations alone might disguise the role of the stereotypes. The gender differences in schooling outcomes were more likely to favor girls in children who were high in academic gender stereotypes (believed in female superiority). For school engagement, the sign of the gender difference even reversed depending on whether students were high or low on gender stereotypes. The nature of the moderation was consistent with the gender-typing of the outcome variables—stronger belief in female superiority was associated with larger gender differences favoring girls in female-stereotyped outcomes (school engagement, Chinese, and English) and weaker belief in female superiority was associated with larger gender difference favoring boys in the male-stereotyped outcome (Math). Believing in the stereotypes and believing that adults held those stereotypes showed similar moderating effects for school engagement and English exam scores.

### Implications

Documenting the divergence in gender stereotypes about academic and career success and the evidence that they moderated the magnitude and direction of gender differences in school engagement and exam scores have important implications. Although this study assessed descriptive stereotypes (“what is”), descriptive stereotypes are prone to transform to attitudes (“what should”). Most children endorse or follow stereotypes but some disrupt and challenge them (Rogers, 2020). If children’s knowledge about academic and career gender stereotypes are acquired early, the next step might be to couple this knowledge with ways to disrupt the impact of these stereotypes before they are consolidated. Others have shown that teaching children explicitly about sexism and practicing anti-sexist remarks could equip children to identify and challenge sexism (Lamb et al., 2009; Pahlke et al., 2014).

Although stereotypes may reflect knowledge of actual situations, they may still have developmental implications because for stereotype threat or self-fulfilling prophecy to work, there has to be a widespread stereotype and the person is aware of the stereotype (Hartley & Sutton, 2013; Steele & Aronson, 1995). Effects of stereotypes have been demonstrated for various performance tasks, whereby believing that the own group is negatively stereotyped leads to worse performance due to anxiety and cognitive load (Hartley & Sutton, 2013; Steele & Aronson, 1995). The moderation effects of academic gender stereotypes on gender differences

in exam scores provided indirect support for these well-known findings. However, effects of gender stereotypes may go beyond task performance measurable by marks to affect school engagement as we showed, as well as career choices and goals. Indeed, beliefs that the prototypical member is of another gender is known to lower sense of belonging and self-efficacy in a given field and people are less motivated to pursue something perceived as “not for them” (Bian, 2022; Ellemers, 2018). Thus, if schools are perceived to favor a feminine culture and girls are the better students, boys may be demotivated at school (Browne, 2013), and the reverse may occur for girls in regards to their career pursuits. While studies have shown that ability stereotypes can be manipulated to influence test performance (e.g., Hartley & Sutton, 2013), it remains unexplored whether academic stereotypes and career stereotypes can be altered to address non-ability attributes such as school engagement and setting high career goals.

Gender stereotypes that go unnoticed or unchallenged may be especially self-fulfilling. For example, real-world experiments have shown that when people were unaware of what stereotypes they held, they exhibited more biased behavior (Regner et al., 2019). Others have argued that awareness of a gender stereotype without knowing how to mitigate it may also lead the stereotypes to self-fulfill, as knowledge of discrimination and inequality may reduce self-efficacy (William & Ceci, 2015). Knowledge about the development and nature of various stereotypes should thus be communicated with children and their caregivers, coupled with education about effective interventions and presentation of diverse role models.

## Limitations

While this study contributes to the understanding of development, and roles of academic and career gender stereotypes in a large sample of children, there are several limitations. First, we did not include preschool children or adolescents, thus were unable to study the gender stereotypes outside middle childhood. Future studies including a wider age range could address questions such as whether the stereotypes were present before primary school and whether the belief in female superiority at school and that at work would become negatively correlated after middle childhood.

Second, although we were able to investigate the moderating role of stereotypes on behavioral gender differences using the cross-sectional design, causal roles of the stereotypes in affecting individual differences in the outcomes require longitudinal and experimental designs. A longitudinal design would also offer further insights into developmental changes.

Third, to be comparable to the study that employed the academic gender stereotype measures (Hartley & Sutton, 2013), the stereotype measures in this study involved a forced choice, boy/man versus girl/woman option. A “both

gender” option may be included for the purpose of capturing knowledge as well as belief (or flexibility) (Ruble et al., 2006). A new career gender stereotype scale was developed to measure perceptions of general career success but one caveat is that it focuses on traditionally defined indicators of success which have been studied in the literature of gender differences in occupational achievements. Also, we did not assess career gender meta-stereotype, as we did the academic domain. Future studies may expand the career gender stereotype measures.

## Conclusions

To conclude, by assessing academic and career gender stereotypes, we showed that children in primary school already acquired the perception that girls do better at school but men have more successful careers. Younger children believed their own gender was better in both arenas but this naivete was taken over by more realistic perceptions in older children. At the end of primary school, the stereotypes about which gender was higher achieving at school and at work diverged both at the group and within-person levels. Also, the magnitude and direction of gender differences in school engagement and exam scores depended on the extent to which children believed that girls or boys were academically superior. These insights provide important data that buttress debates about why girls’ academic advantages do not translate to career outcomes and the importance of early education about stereotypes.

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**Data Availability** Data, codes, and materials are available upon request.

## Declarations

**Conflict of interest** The authors declare no conflicts of interest.

**Ethical approval** Ethics approval was obtained from the institutional ethics committee.

**Informed consent** Informed consent was obtained from the parents and teachers. Assent was obtained from child participants.

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