Checking Gender Bias: Parents and Mentors Perceive Less Chess Potential in Girls

Supplementary Online Materials

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Section 1: Recruitment Email

We sent two emails to the US Chess Federation Members mailing list. There was no mention of gender in either email. Given that two of the authors are well known for advocating for gender equality in chess and the other three authors study gender biases, we opted to sign our email without any of our names. Instead, we simply signed as “The Chess Survey Research Team.” Participants were given an anonymous chess-related Gmail account to email with questions before the survey. At the end of the survey, participants were debriefed and given the name and email of the first author to reach out to with any questions or feedback.

Initial Invitation:
Dear USCF member,

We are conducting a brief (15-minute) survey about factors that are important to success in chess. We are interested in learning about your experiences as a chess player, parent of a chess player, or coach/mentor of chess players. Your perspective is extremely valuable to us. To thank you for participating in the survey, the first 100 people to complete the survey will receive a $10 Amazon gift card upon completion.

To participate in the survey, please click on the link: [SURVEY LINK]. Thank you so much for your time. We look forward to your response!

Sincerely,
The Chess Survey Research Team

Please be assured your responses will be kept completely confidential, and we will *not* ask you to provide or automatically collect any personally identifying information. This study has been approved by [BLINDED IRB]. If you have any questions about this survey, please reply to this email or email one of the researchers at [RESEARCH TEAM EMAIL].

Follow-up Invitation:
Dear USCF member,

About a week ago, we contacted you about a brief (15-minute) survey about factors that are important to success in chess. We are interested in learning about your experiences as a chess player, parent of a chess player, or coach/mentor of chess players. Your perspective is extremely valuable to us. To thank you for participating in the survey, the first 100 people to complete the survey will receive a $10 Amazon gift card upon completion.

If you haven’t completed the study yet but would like to, please follow this link to provide your responses: [SURVEY LINK]. Thank you so much for your time. We look forward to your response!

Sincerely,

The Chess Survey Research Team

Please be assured your responses will be kept completely confidential, and we will *not* ask you to provide or automatically collect any personally identifying information. This study has been approved by [BLINDED IRB]. If you have any questions about this survey, please reply to this email or email one of the researchers at [RESEARCH TEAM EMAIL].

Section 2: Measures

Potential US Chess Rating

If [child/mentee] currently competes in US Chess tournaments (*n* = 85 children, 24% daughters; *n* = 283 mentees, 15% female)*:*

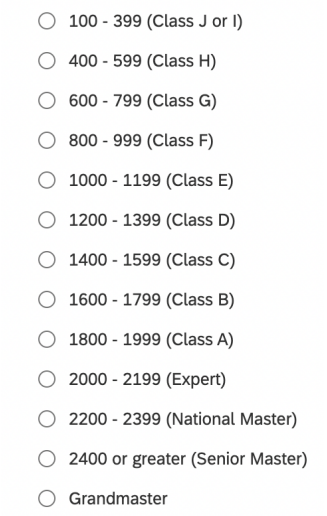
> For the following question, please think about [child/mentee]'s chess potential. Assuming [child/mentee] continues with chess, what is the highest US Chess rating you think [child/mentee] could achieve in their chess career?

If [child/mentee] has never competed in US Chess tournaments (*n* = 53 children, 36% daughters; *n* = 141 mentees, 21% female)*:*

> For the following question, please think about [child/mentee]'s chess potential. Assuming [child/mentee] starts competing in US Chess Tournaments, what is the highest US Chess rating you think [child/mentee] could achieve in their chess career?

If [child/mentee] used to compete in US Chess tournaments, but no longer competes (*n* = 86 children, 17% daughters; *n* = 0 mentees):

> For the following question, please think about [child/mentee]'s chess potential. Assuming [child/mentee] started competing in US Chess Tournaments again, what is the highest US Chess rating you think [child/mentee] could achieve in their chess career?



Inherent Chess Ability

What is/was [child/mentee]'s inherent chess ability? (*very low ability* [0], *very high ability* [100])

Inherent Chess Interest

How inherently interested in chess is/was [child/mentee]? (*not at all interested* [0], *extremely interested* [100])

Supportive Chess Environment

Parents:

How supportive is/was [child]'s chess environment (for example, sufficient mentorship, friends who are supportive, a positive atmosphere in chess tournaments)? (*not at all supportive* [0], *extremely supportive* [100])

Mentors:
How supportive is [mentee]'s chess environment (for example, sufficient mentorship, friends who are supportive, a positive atmosphere in chess tournaments)?

Reasons to Drop Out of Chess
If [child/mentee] currently competes in US Chess tournaments (*n* = 86 children; *n* = 283 mentees)*:*

For the following questions, assume [child/mentee] stops playing chess competitively.

How responsible would each of the following be for [child/mentee]'s decision to stop playing chess competitively?

If [child/mentee] has never competed in US Chess tournaments (*n* = 59 children, *n* = 141 mentees)*:*

For the following questions, assume [child/mentee] never plays chess competitively.

How responsible would each of the following be for [child/mentee]'s decision to never play chess competitively?

If [child] used to compete in US Chess tournaments, but no longer competes (*n* = 87 children)*:*

For the following questions, please think about why [child/mentee] stopped playing chess competitively.

How responsible were each of the following for [child/mentee]'s decision to stop playing chess competitively?

<u>Lack of Ability</u>
lack of chess ability (*not at all responsible* [0] to *completely responsible* [100])

<u>Lack of Interest</u>
lack of interest in chess (*not at all responsible* [0] to *completely responsible* [100])

<u>Unsupportive Environment</u>
unsupportive chess environment (*not at all responsible* [0] to *completely responsible* [100])

Parent Investment
<u>Frequency</u>

1. You indicated that you (or your family) have acquired **private** lessons for [child]. How often are/were the private lessons for [child]?
    a. more than once per week

   b. once per week
   c. once every two weeks
   d. once a month
   e. less frequently than once a month
   f. other (text entry)
2. How often do/did you typically travel for [child] to compete in US Chess Tournaments? For the purpose of this question, please ignore pandemic related constraints.
   a. more than once a month
   b. once a month
   c. once every few months
   d. twice a year
   e. once a year
   f. I am not willing to travel further than local US Chess Tournaments
3. What is the maximum amount you would be willing to travel in the future if [child] does start competing in US Chess Tournaments? For the purpose of this question, please ignore pandemic related constraints.
   a. more than once a month
   b. once a month
   c. once every few months
   d. twice a year
   e. once a year
   f. I would not be willing to travel, we would only compete in local US Chess tournaments

<u>Monetary</u>

4. You indicated that you (or your family) pays/have paid for private lessons for [child]. How much do/did you pay (per hour) for private lessons for [child]?

   ○ less than $30
   ○ $30-$39
   ○ $40-$49
   ○ $50-$59
   ○ $60-$69
   ○ $70-$79
   ○ $80-$89
   ○ $90-$99
   ○ $100 or more

5. Regardless of whether you currently pay for lessons, what is the largest amount you would be willing to pay per lesson for one hour, weekly chess lessons for [child]?

- ◯ less than $30
- ◯ $30-$39
- ◯ $40-$49
- ◯ $50-$59
- ◯ $60-$69
- ◯ $70-$79
- ◯ $80-$89
- ◯ $90-$99
- ◯ $100 or more

Mentor Investment

1. *If mentor is paid:*
   Even though you are paid to give private lessons for [mentee], have you ever provided unpaid mentorship? For example, an extra free lesson before a tournament? (*never* [0], *frequently* [100])

   If mentor is unpaid:
   You indicated that you are not paid to give chess lessons to [mentee]. Have you ever provided [mentee] extra mentorship? (*never* [0], *frequently* [100])

2. Do you encourage [mentee] to play in US Chess Federation tournaments? (*never* [0], *frequently* [100])
3. Do you suggest additional resources to improve [mentee]'s chess knowledge? For example, advanced training materials like chess books, software, or YouTube videos. (*never* [0], *frequently* [100])
4. In lessons, how often do you present [mentee] with positions that you thought were beyond their ability to solve? (*never* [0], *frequently* [100])
5. How invested are you in [mentee]'s chess playing? (*not at all* [0], *extremely* [100])
6. How proud are you that [mentee] is your mentee? (*not at all* [0], *extremely* [100])
7. Do you think that [mentee] has the potential to outgrow you? (*definitely no* [0], *definitely yes* [100])

Field-Specific Ability Beliefs

Personally, I think that / The chess community at large tends to think that: (from *strongly disagree* [1] to *strongly agree* [7])

1. Being a Chess Master requires a special aptitude that just can't be taught.
2. If you want to be a Chess Master, hard work alone just won't cut it; you need to have an innate gift or talent.
3. With the right amount of effort and dedication, anyone can become a Chess Master. (R)

4. When it comes to chess, the most important factors for success are motivation and sustained effort; raw ability is secondary. (R)

"Brilliance = Men" Stereotypes

Personally, I think that / The chess community at large tends to think that: (from *strongly disagree* [1] to *strongly agree* [7])

1. One is more likely to find a male with a genius-level "chess IQ" than a female with a genius-level "chess IQ".
2. Extreme chess brilliance is more common in men than in women.
3. On average, men tend to have higher chess capacities than women.
4. Even though it's not true of everyone, males are generally born with greater raw chess ability than females.
5. The reason why there are few female chess players is that women tend to think more cooperatively.
6. Men and women have complementary cognitive skills: Men are better at understanding objects and mechanical systems, whereas women are better at understanding people and their emotions.
7. Even though it may not be politically correct to say it, males and females might be naturally suited for different kinds of intellectual activities.
8. Males' and females' biology has an effect on their cognitive abilities (even though the differences might be small).

Section 3: Analyses with Community FAB and Community "Brilliance = Men" Stereotypes

In this section, we report all the analyses in the main text with participants' estimation of the **chess community**'s agreement with field-specific ability beliefs about chess and the "brilliance = men" stereotypes about chess.

Table S1

Linear Mixed-Effects Regression Results for Participants' Evaluations of Youth Players by Community Estimations of FAB and B=M

	Potential			**Ability**			**Interest**			**Environment**		
Predictors	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*
(Intercept)	9.05	0.13	<0.001	70.04	1.06	<0.001	66.93	1.22	<0.001	71.43	1.31	<0.001
Girl (girl = 1, boy = 0)	-0.66	0.21	**0.002**	-1.46	2.06	0.479	-0.47	2.53	0.852	-0.19	2.13	0.928
FAB	0.20	0.13	0.110	1.08	1.02	0.295	-0.88	1.18	0.457	0.58	1.26	0.644
B=M	0.09	0.12	0.472	-1.19	0.99	0.232	0.71	1.14	0.534	-1.82	1.22	0.138
Mentor (mentor = 1, parent = 0)	-0.23	0.18	0.215	-2.02	1.74	0.246	6.97	2.11	**<0.001**	-5.96	1.86	**0.001**
Girl * FAB	-0.16	0.19	0.403	-2.49	1.91	0.193	1.28	2.33	0.584	1.16	1.97	0.557
Girl * B=M	0.19	0.19	0.334	1.62	1.92	0.399	0.24	2.36	0.919	-1.32	1.96	0.501
FAB * B=M	0.21	0.08	**0.010**	0.03	0.64	0.964	0.02	0.74	0.980	-0.47	0.80	0.558
Girl * Mentor	-0.20	0.42	0.631	0.87	4.15	0.834	7.68	5.08	0.132	9.60	4.29	**0.026**
FAB * Mentor	0.08	0.18	0.637	1.34	1.69	0.427	-1.48	2.05	0.471	1.13	1.80	0.530
B=M * Mentor	0.01	0.17	0.951	-0.52	1.62	0.749	1.58	1.96	0.420	1.17	1.76	0.509
Girl * FAB * B=M	0.06	0.10	0.582	-1.85	1.00	0.065	-3.07	1.24	**0.013**	-0.98	1.02	0.334
Girl * FAB * Mentor	0.01	0.38	0.971	-0.67	3.72	0.858	6.20	4.57	0.176	-1.48	3.85	0.700
Girl * B=M * Mentor	-0.28	0.40	0.489	3.50	3.93	0.374	-6.46	4.83	0.182	-3.30	4.06	0.416
FAB * B=M * Mentor	0.11	0.11	0.277	-0.00	1.01	0.997	-0.22	1.23	0.860	0.64	1.07	0.553
Girl * FAB * B=M * Mentor	0.16	0.21	0.436	-0.69	2.04	0.735	-0.45	2.53	0.859	-2.51	2.09	0.230
	SD			*SD*			*SD*			*SD*		
Participant Random Intercept	1.64			11.60			12.26			16.43		
N	264			263			264			262		
Observations	642			640			642			641		
Marginal R^2 / Conditional R^2	0.042 / 0.524			0.023 / 0.339			0.045 / 0.286			0.031 / 0.510		

Note. Estimates (with standard error) and goodness-of-fit statistics for the four separate linear mixed effects models regressing parents and mentors' evaluations of their children and mentees' potential US Chess rating, inherent chess ability, inherent chess interest, and supportive environment respectively, on the youth player's gender (Girl; girls = 1, boys = 0), their estimation of the chess community's FAB (FAB), their estimation of the chess community's "brilliance = men" stereotype (B=M), their relationship to the youth player (Mentor; mentors = 1, parents = 0), and their interactions. All variables are mean-centered to facilitate interpretation of lower-order effects.

Table S2

Linear Mixed-Effects Regression Results for Participants' Evaluations of Youth Players' Likelihood of Dropping out of Chess by Community Estimations of FAB and B=M

	Low Ability			**Low Interest**			**Unsupportive Environment**		
Predictors	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*
(Intercept)	34.78	1.59	<.001	56.15	1.72	<.001	44.15	1.84	<.001
Girl (girl = 1, boy = 0)	1.41	2.74	.606	3.79	2.99	.204	-3.38	2.95	.253
FAB	-1.18	1.53	.441	0.69	1.66	.679	-0.94	1.77	.598
B=M	2.77	1.48	.063	3.49	1.61	**.031**	3.63	1.72	**.036**
Mentor (mentor = 1, parent = 0)	7.48	2.36	**.002**	-5.32	2.56	**.038**	6.90	2.59	**.008**
Girl * FAB	8.83	2.54	**<.001**	-0.67	2.77	.809	4.31	2.73	.115
Girl * B=M	-0.65	2.52	.797	-0.06	2.82	.983	3.30	2.77	.235
FAB * B=M	-0.61	0.97	.531	2.09	1.05	**.047**	1.24	1.13	.272
Girl * Mentor	-5.36	5.49	.330	-1.62	5.99	.077	3.35	5.95	.574
FAB * Mentor	-0.92	2.30	.691	6.59	2.48	**.008**	1.17	2.50	.639
B=M * Mentor	1.90	2.22	.391	5.95	2.41	**.014**	-1.67	2.45	.495
Girl * FAB * B=M	1.98	1.31	.131	-0.26	1.45	.859	2.07	1.44	.149
Girl * FAB * Mentor	5.96	4.92	.227	-7.66	5.38	.155	0.35	5.33	.947
Girl * B=M * Mentor	-11.48	5.20	**.028**	5.76	5.74	.316	3.14	5.68	.581
FAB * B=M * Mentor	0.04	1.36	.975	2.82	1.48	.057	4.62	1.49	**.002**
Girl * FAB * B=M * Mentor	-3.56	2.67	.184	3.01	2.95	.308	0.80	2.92	.785
	SD			*SD*			*SD*		
Participant Random Intercept	19.26			20.73			23.19		
N	263			264			262		
Observations	638			638			637		
Marginal R^2 / Conditional R^2	.056 / .477			.055 / .469			.055 / .533		

Note. Estimates (with standard error) and goodness-of-fit statistics for the three separate linear mixed effects models regressing parents and mentors' evaluations of their children and mentees' reasons to drop out of chess due to a lack of chess ability, lack of chess interest, and lack of supportive environment, respectively, on the youth player's gender (Girl; girls = 1, boys = 0), their estimation of the chess community's FAB (FAB), their estimation of the chess community's "brilliance=men" stereotype (B=M), their relationship to the youth player (Mentor; mentors = 1, parents = 0), and their interactions. All variables are mean-centered to facilitate interpretation of lower-order effects.

Table S3

Linear Mixed-Effects Regression Results for Participants' Evaluations of Youth Players by Community Estimations of FAB and "Brilliance = Men" Stereotypes

	Parent Investment			**Mentor Investment**		
Predictors	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*
(Intercept)	-0.08	0.06	0.172	65.84	1.45	<0.001
Girl	-0.04	0.09	0.649	-1.10	1.74	0.530
FAB	-0.06	0.06	0.295	-0.11	1.38	0.936
B=M	0.07	0.05	0.194	1.04	1.38	0.452
Girl * FAB	-0.12	0.10	0.216	0.28	1.59	0.860
Girl * B=M	0.03	0.09	0.717	-2.32	1.61	0.151
FAB * B=M	0.01	0.04	0.696	0.99	0.85	0.249
Girl * FAB * B=M	-0.03	0.04	0.413	-0.29	0.80	0.719
	SD			*SD*		
Participant Random Intercept	0.68			16.04		
N	172			153		
Observations	225			419		
Marginal R^2 / Conditional R^2	0.021 / 0.871			0.012 / 0.704		

Note. Estimates (with standard error) and goodness-of-fit statistics for the two separate linear mixed effects models regressing parents and mentors' investment in their children and mentees, respectively, on the youth player's gender (Girl; girls = 1, boys = 0), their estimation of the chess community's FAB (FAB), their estimation of the chess community's "brilliance = men" stereotype (B=M), and their interactions. All variables are mean-centered to allow for interpretation of lower-order effects.

Section 4: Analyses with Additional Controls

In this section, we report all the analyses in the main text with additional covariates. We report these additional covariates in two models. The first model includes only participants' (i.e., parents' and mentors') and youths' age and participants' gender. This first model retains most of the observations from the main text (94%). The second model includes the covariates from the first model, as well as participants' US Chess rating and youths' US Chess rating. This second model retains only 52% of observations, so comparisons between this model and the model in the main text should be made with caution. To note, both models suggest similar patterns of gender bias as reported in the main text.

Table S4

Linear Mixed-Effects Regression Results for Participants' Evaluations of Youth Players' Potential adjusting for (1) Youths' Age, Participants' Age, Participants' Gender, and in Addition, (2) Youths' USCF Rating and Participants' USCF Rating

	Potential: 1			**Potential: 2**		
Predictors	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*
(Intercept)	10.17	0.68	<0.001	7.05	0.79	<0.001
Girl (girl = 1, boy = 0)	-0.78	0.21	**<0.001**	-0.30	0.24	0.210
FAB	-0.16	0.10	0.111	-0.25	0.11	**0.022**
B=M	-0.12	0.09	0.194	-0.18	0.10	0.058
Mentor (mentor = 1, parent = 0)	-0.30	0.19	0.111	-0.51	0.20	**0.010**
Girl * FAB	-0.30	0.16	0.067	-0.15	0.21	0.471
Girl * B=M	-0.03	0.14	0.818	-0.16	0.17	0.328
FAB * B=M	0.10	0.06	0.111	0.15	0.06	**0.019**
Girl * Mentor	-0.12	0.42	0.773	0.75	0.47	0.111
FAB * Mentor	0.02	0.15	0.917	0.15	0.16	0.329
B=M * Mentor	0.06	0.13	0.663	-0.15	0.14	0.285
Girl * FAB * B=M	0.06	0.09	0.513	-0.01	0.11	0.952
Girl * FAB * Mentor	0.19	0.32	0.547	0.29	0.40	0.474
Girl * B=M * Mentor	-0.14	0.27	0.595	0.05	0.30	0.870
FAB * B=M * Mentor	0.09	0.09	0.325	0.16	0.09	0.086
Girl * FAB * B=M * Mentor	-0.03	0.18	0.881	0.02	0.21	0.921
Parent/Mentor Age	-0.02	0.01	0.073	-0.01	0.01	0.239
Youth Age	-0.03	0.01	**<0.001**	-0.04	0.01	**<0.001**
Woman (woman = 1, man = 0)	0.36	0.37	0.335	0.39	0.41	0.346
Parent/Mentor USCF rating				0.14	0.06	**0.029**
Youth USCF rating				0.37	0.04	**<0.001**
	SD			*SD*		
Participant Random Intercept	1.49			1.18		
N	255			146		
Observations	619			345		
Marginal R^2 / Conditional R^2	0.141 / 0.539			0.390 / 0.700		

Note. Estimates (with standard error) and goodness-of-fit statistics for the separate linear mixed effects models regressing parents and mentors' evaluations of their children and mentees' potential US Chess rating on (1) the youth player's gender (Girl; girls = 1, boys = 0), their FAB (FAB), "brilliance = men" stereotype (B=M), their relationship to the youth player (Mentor; mentors = 1, parents = 0), all interactions, adjusting for youth age, parents and mentors' age, and parents' and mentors' gender and (2) the same model as (1) with the following additional covariates: parents' and mentors' USCF rating and youths' USCF rating. All interacting variables are mean-centered to facilitate interpretation of lower-order effects. Covariates are not mean-centered.

Table S5

Linear Mixed-Effects Regression Results for Participants' Evaluations of Youth Players Adjusting for (1) Youths' Age, Participants' Age, Participants' Gender, and in Addition, (2) Youths' USCF Rating and Participants' USCF Rating

	Ability: 1			**Ability: 2**			**Interest: 1**			**Interest: 2**			**Environment: 1**			**Environment: 2**		
Predictors	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*
(Intercept)	63.81	5.75	<0.001	57.27	8.99	<0.001	50.14	6.57	<0.001	61.88	9.27	<0.001	79.92	7.28	<0.001	69.32	10.43	<0.001
Girl (girl = 1, boy = 0)	-3.22	2.10	0.125	2.78	2.69	0.303	-0.87	2.57	0.736	9.48	3.65	**0.010**	-1.64	2.19	0.455	5.27	3.08	0.088
FAB	0.16	0.86	0.851	-0.63	1.24	0.611	-0.19	0.98	0.848	0.74	1.29	0.570	0.06	1.10	0.957	0.27	1.44	0.851
B=M	-1.46	0.78	0.061	-0.58	1.09	0.595	-0.49	0.88	0.578	-0.16	1.13	0.887	0.47	0.99	0.631	0.49	1.27	0.698
Mentor (mentor = 1, parent = 0)	-2.20	1.78	0.217	-2.87	2.23	0.199	8.04	2.15	**<0.001**	9.75	2.90	**<0.001**	-4.68	1.95	**0.017**	-6.70	2.56	**0.009**
Girl * FAB	0.46	1.61	0.775	0.75	2.35	0.751	-1.45	1.97	0.464	2.06	3.25	0.528	-0.42	1.71	0.808	-1.80	2.70	0.504
Girl * B=M	-2.34	1.43	0.102	-2.18	1.88	0.249	-3.93	1.75	**0.025**	-3.69	2.53	0.145	1.42	1.49	0.343	-0.37	2.16	0.865
FAB * B=M	-0.42	0.51	0.410	-0.18	0.72	0.806	-1.90	0.59	**0.001**	-0.39	0.75	0.606	-0.39	0.65	0.549	-0.51	0.84	0.546
Girl * Mentor	1.55	4.16	0.709	7.68	5.25	0.145	7.22	5.10	0.157	4.58	7.13	0.521	13.17	4.37	**0.003**	18.33	5.99	**0.002**
FAB * Mentor	-1.84	1.44	0.202	-1.80	1.75	0.303	-4.83	1.74	**0.006**	-2.73	2.24	0.224	2.45	1.59	0.123	2.48	2.01	0.218
B=M * Mentor	0.94	1.25	0.453	0.96	1.53	0.533	3.68	1.51	**0.015**	4.38	1.99	**0.028**	0.11	1.35	0.933	-2.20	1.75	0.211
Girl * FAB * B=M	-0.07	0.86	0.938	-1.07	1.25	0.390	-0.63	1.06	0.552	-1.02	1.76	0.564	-0.24	0.90	0.793	-3.09	1.43	**0.031**
Girl * FAB * Mentor	-1.48	3.20	0.644	-1.63	4.48	0.716	4.43	3.95	0.263	7.70	6.21	0.216	-5.14	3.36	0.126	-10.24	5.13	**0.047**
Girl * B=M * Mentor	1.68	2.70	0.534	5.50	3.42	0.108	-3.75	3.32	0.259	-1.27	4.65	0.785	0.03	2.81	0.992	4.61	3.89	0.238
FAB * B=M * Mentor	0.17	0.87	0.844	0.74	1.01	0.467	-1.13	1.05	0.285	0.09	1.31	0.947	-0.82	0.95	0.386	-0.92	1.16	0.430
Girl * FAB * B=M * Mentor	-1.69	1.74	0.333	-1.33	2.36	0.573	-1.46	2.15	0.498	3.48	3.28	0.290	-5.00	1.82	**0.006**	-9.36	2.70	**<0.001**
Parent/Mentor Age	0.09	0.08	0.232	0.15	0.11	0.173	0.06	0.09	0.521	-0.09	0.12	0.457	-0.25	0.10	**0.012**	-0.26	0.13	**0.050**
Youth Age	-0.32	0.06	**<0.001**	-0.44	0.07	**<0.001**	0.02	0.07	0.755	0.08	0.09	0.367	-0.09	0.06	0.168	0.04	0.08	0.668
Woman (woman = 1, man = 0)	7.26	3.16	**0.022**	5.27	4.66	0.261	12.99	3.61	**<0.001**	3.93	4.65	0.400	6.29	4.00	0.117	9.44	5.41	0.084
Parent/Mentor USCF rating				-0.84	0.71	0.234				-1.74	0.75	**0.022**				0.72	0.82	0.383
Youth USCF rating				3.11	0.41	**<0.001**				3.64	0.54	**<0.001**				0.46	0.48	0.334
	SD			*SD*			*SD*			*SD*			*SD*			*SD*		
Participant Random Intercept	10.59			13.49			10.50			9.60			16.16			15.77		
N	254			146			255			146			253			145		
Observations	617			343			620			345			618			344		
Marginal R^2 / Conditional R^2	0.103 / 0.362			0.215 / 0.624			0.103 / 0.282			0.223 / 0.370			0.069 / 0.526			0.094 / 0.576		

Note. Estimates (with standard error) and goodness-of-fit statistics for the separate linear mixed effects models regressing parents and mentors' evaluations of their children and mentees' chess ability, chess interest, and supportiveness of their chess environment on (1) the youth player's gender (Girl; girls = 1, boys = 0), their FAB (FAB), "brilliance = men" stereotype (B=M), their relationship to the youth player (Mentor; mentors = 1, parents = 0), all interactions, adjusting for youth age, parents and mentors' age, and parents' and mentors' gender and (2) the same model as (1) with the following additional covariates: parents' and mentors' USCF rating and youths' USCF rating. All interacting variables are mean-centered to facilitate interpretation of lower-order effects. Covariates are not mean-centered.

Table S6

Linear Mixed-Effects Regression Results for Participants' Evaluations of Youth Players' Likelihood of Dropping out of Chess Adjusting for (1) Youths' Age, Participants' Age, Participants' Gender, and in Addition, (2) Youths' USCF Rating and Participants' USCF Rating

	Stop Ability: 1			**Stop Ability: 2**			**Stop Interest: 1**			**Stop Interest: 2**			**Stop Environment: 1**			**Stop Environment: 2**		
Predictors	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*
(Intercept)	19.66	8.65	**0.023**	39.70	13.27	**0.003**	89.43	9.44	**<0.001**	72.90	14.26	**<0.001**	24.37	10.61	**0.023**	65.70	15.38	**<0.001**
Girl	5.03	2.86	0.080	3.59	4.14	0.386	3.86	3.01	0.120	5.37	4.36	0.219	0.28	3.06	0.926	0.39	4.36	0.928
FAB	0.50	1.30	0.700	0.51	1.85	0.785	1.15	1.42	0.418	1.91	1.96	0.333	-0.97	1.60	0.545	-1.49	2.12	0.484
B=M	1.45	1.17	0.218	4.26	1.62	**0.010**	1.23	1.28	0.336	0.72	1.73	0.681	-0.32	1.44	0.824	-0.28	1.87	0.882
Mentor	7.12	2.50	**0.005**	9.99	3.41	**0.004**	-3.09	2.62	0.238	-3.92	3.58	0.274	6.66	2.73	**0.015**	11.05	3.63	**0.003**
Girl * FAB	1.65	2.22	0.457	0.51	3.64	0.889	3.01	2.32	0.195	-0.41	3.82	0.915	-5.30	2.38	**0.026**	-2.23	3.80	0.558
Girl * B=M	1.48	1.95	0.450	2.11	2.89	0.466	1.86	2.05	0.365	1.85	3.03	0.542	0.02	2.08	0.994	2.51	3.04	0.410
FAB * B=M	0.68	0.78	0.383	0.71	1.07	0.512	2.31	0.85	**0.007**	0.86	1.15	0.455	0.82	0.95	0.389	3.63	1.24	**0.004**
Girl * Mentor	-1.95	5.67	0.732	-8.41	8.04	0.297	-9.01	5.97	0.132	-11.36	8.47	0.181	5.68	6.11	0.353	-5.65	8.49	0.506
FAB * Mentor	0.80	2.04	0.695	0.25	2.68	0.926	2.13	2.13	0.317	-1.39	2.80	0.620	1.39	2.23	0.534	6.53	2.87	**0.023**
B=M * Mentor	-1.58	1.74	0.363	-0.56	2.34	0.812	3.50	1.82	0.055	4.36	2.45	0.076	-1.18	1.89	0.534	-0.82	2.48	0.741
Girl * FAB * B=M	-0.46	1.17	0.696	-0.26	1.93	0.894	-0.58	1.23	0.636	-1.52	2.02	0.453	-1.35	1.25	0.281	1.25	2.01	0.534
Girl * FAB * Mentor	8.95	4.36	**0.040**	4.67	6.90	0.499	-4.98	4.57	0.276	-11.79	7.22	0.104	7.14	4.67	0.127	20.72	7.22	**0.004**
Girl * B=M * Mentor	-6.16	3.67	0.094	-4.95	5.24	0.345	3.04	3.85	0.429	7.25	5.49	0.188	-0.78	3.91	0.843	-5.04	5.49	0.360
FAB * B=M * Mentor	0.17	1.22	0.890	0.66	1.55	0.670	-0.65	1.28	0.614	-1.83	1.63	0.261	3.71	1.33	**0.006**	5.20	1.65	**0.002**
Girl * FAB * B=M * Mentor	-2.60	2.36	0.273	-1.95	3.64	0.594	1.29	2.48	0.604	-2.89	3.82	0.450	0.12	2.53	0.963	10.46	3.81	**0.006**
Parent/Mentor Age	0.19	0.12	0.109	0.22	0.17	0.183	-0.43	0.13	**<0.001**	-0.34	0.18	0.054	0.22	0.14	0.122	0.37	0.19	0.052
Youth Age	0.31	0.08	**<0.001**	0.31	0.11	**0.005**	-0.31	0.09	**<0.001**	-0.39	0.12	**<0.001**	0.01	0.09	0.897	-0.16	0.12	0.184
Woman	-1.51	4.75	0.750	-3.55	6.87	0.606	-3.54	5.18	0.494	2.94	7.37	0.690	6.94	5.82	0.234	-21.46	7.99	**0.008**
Parent/Mentor USCF rating				-0.54	1.05	0.605				3.32	1.12	**0.003**				-3.18	1.20	**0.009**
Youth USCF rating				-2.94	0.63	**<0.001**				-3.44	0.67	**<0.001**				1.30	0.67	0.055
	SD			*SD*			*SD*			*SD*			*SD*			*SD*		
Participant Random Intercept	17.90			19.37			20.13			21.10			24.19			27.79		
N	254			145			255			146			253			145		
Observations	615			343			615			342			614			341		
Marginal R^2 / Conditional R^2	0.086 / 0.452			0.163 / 0.563			0.109 / 0.500			0.205 / 0.604			0.053 / 0.559			0.178 / 0.648		

Note. Estimates (with standard error) and goodness-of-fit statistics for the three separate linear mixed effects models regressing parents and mentors' evaluations of their children and mentees' reasons to drop out of chess due to a lack of chess ability, lack of chess interest, and lack of supportive environment, respectively, on (1) the youth player's gender (Girl; girls = 1, boys = 0), their FAB (FAB), "brilliance=men" stereotype (B=M), their relationship to the youth player (Mentor; mentors = 1, parents = 0), all interactions, adjusting for youth age, parents and mentors' age, and parents' and mentors' gender and (2) the same model as (1) with the following additional covariates: parents' and mentors' USCF rating and youths' USCF rating. All interacting variables are mean-centered to facilitate interpretation of lower-order effects. Covariates are not mean-centered.

Table S7

Linear Mixed-Effects Regression Results for Participants' Evaluations of Youth Players Adjusting for (1) Youths' Age, Participants' Age, Participants' Gender, and in Addition, (2) Youths' USCF Rating and Participants' USCF Rating

	Parent Investment: 1			**Parent Investment: 2**			**Mentor Investment: 1**			**Mentor Investment: 2**		
Predictors	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*
(Intercept)	0.09	0.35	0.793	-0.39	0.52	0.460	64.58	8.10	<0.001	77.66	10.27	<0.001
Girl (girl = 1, boy = 0)	-0.07	0.09	0.427	0.03	0.12	0.811	-1.22	1.83	0.504	2.84	2.29	0.217
FAB	-0.04	0.05	0.393	-0.00	0.05	0.973	-2.27	1.19	0.058	-2.52	1.38	0.070
B=M	-0.00	0.04	0.927	0.01	0.04	0.795	-0.12	1.08	0.910	-1.31	1.28	0.309
Girl * FAB	0.04	0.08	0.566	0.14	0.09	0.122	-0.61	1.35	0.651	0.45	2.04	0.825
Girl * B=M	-0.10	0.06	0.070	-0.13	0.07	0.071	-1.68	1.29	0.193	1.50	1.84	0.416
FAB * B=M	0.03	0.03	0.235	0.00	0.03	0.887	-0.88	0.71	0.221	0.91	0.82	0.272
Girl * FAB * B=M	0.04	0.04	0.381	0.04	0.05	0.396	0.17	0.69	0.804	1.32	1.12	0.240
Parent/Mentor Age	-0.00	0.01	0.648	-0.01	0.01	0.319	-0.06	0.10	0.578	0.08	0.12	0.518
Youth Age	-0.01	0.01	0.059	-0.03	0.01	**0.009**	-0.08	0.05	0.088	-0.10	0.05	0.054
Woman (woman = 1, man = 0)	0.19	0.17	0.267	0.44	0.30	0.151	6.43	4.69	0.173	0.63	4.76	0.895
Parent/Mentor USCF rating				0.03	0.03	0.349				-3.09	0.87	**<0.001**
Youth USCF rating				0.13	0.02	**<0.001**				2.95	0.36	**<0.001**
	SD			*SD*			*SD*			*SD*		
Participant Random Intercept	0.66			0.47			15.53			14.12		
N	164			77			151			99		
Observations	213			109			408			236		
Marginal R^2 / Conditional R^2	0.081 / 0.879			0.371 / 0.841			0.069 / 0.721			0.211 / 0.814		

Note. Estimates (with standard error) and goodness-of-fit statistics for the two separate linear mixed effects models regressing parents and mentors' investment in their children and mentees, respectively, on (1) the youth player's gender (Girl; girls = 1, boys = 0), their FAB (FAB), "brilliance = men" stereotype (B=M), their relationship to the youth player (Mentor; mentors = 1, parents = 0), all interactions, adjusting for youth age, parents and mentors' age, and parents' and mentors' gender and (2) the same model as (1) with the following additional covariates: parents' and mentors' USCF rating and youths' USCF rating. All interacting variables are mean-centered to facilitate interpretation of lower-order effects. Covariates are not mean-centered.

Section 5: Parent and Mentor Investment Scales

Parent Investment

Table S8
Correlation Matrix of Parent Investment Measures

	1	*2*	*3*	*4*	*5*
[1] Lesson Money					
[2] Lesson Frequency	-0.088				
[3] Lesson Money Future	0.853***	-0.082			
[4] Tournament Travel	0.207	-0.137	0.215		
[5] Tournament Travel Future	0.036	-0.139	0.121	0.793***	

Computed correlation used Pearson method with listwise deletion.

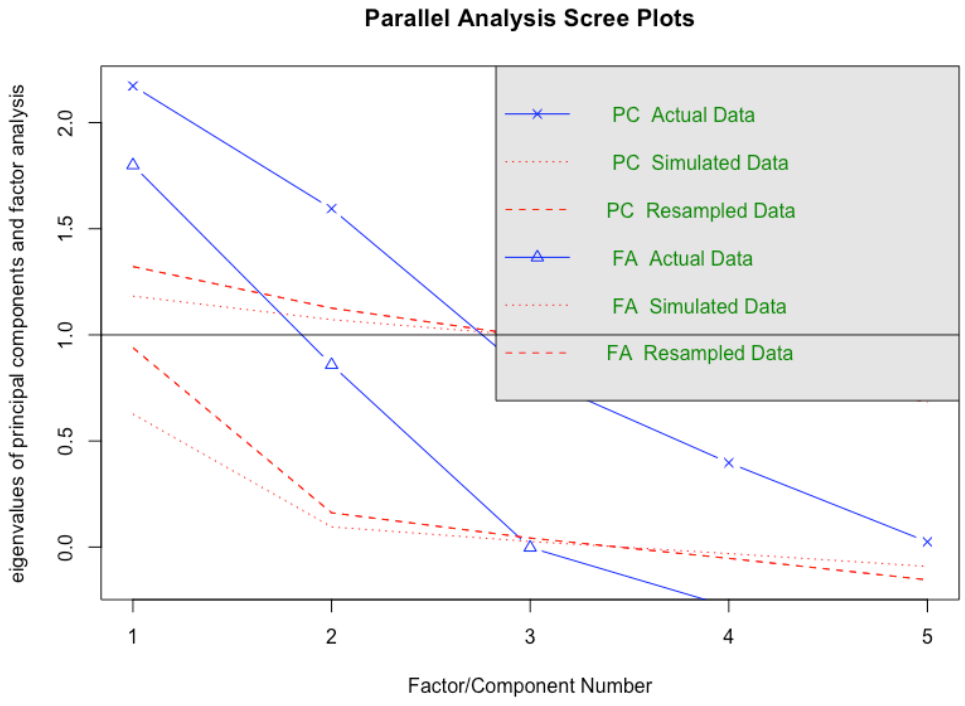


Table S9

Principal Component Analysis Loadings for Items Measuring Parents' Investment in Their Children

	Component 1	**Component 2**
Lesson Money	-0.08	**0.98**
Lesson Frequency	**0.65**	-0.08
Tournament Travel	**0.84**	0.16
Lesson Money Future	0.21	**0.94**
Tournament Travel Future	**0.83**	0.10

Note. This is the output of a principal component analysis with varimax rotation.

Mentor Investment

Table S10
Correlation Matrix of Mentor Investment Measures

	1	*2*	*3*	*4*	*5*	*6*	*7*
[1] extra							
[2] tournament	0.195***						
[3] resources	0.285***	0.511***					
[4] challenge	0.143**	0.267***	0.370***				
[5] invest	0.305***	0.402***	0.544***	0.350***			
[6] proud	0.266***	0.373***	0.508***	0.358***	0.696***		
[7] outgrow	0.095	0.339***	0.324***	0.220***	0.359***	0.476***	

Computed correlation used Pearson method with listwise deletion.

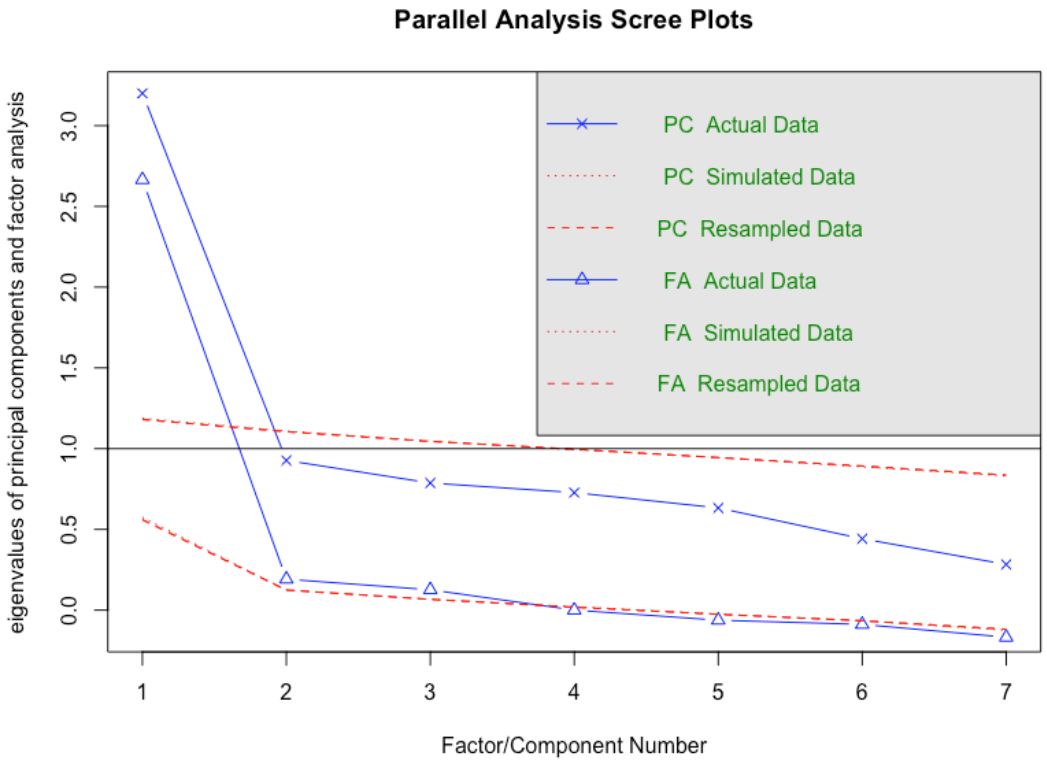


Table S11

Principal Component Analysis Loadings for Items Measuring Mentors' Investment in Their Mentees

	Component 1
extra	0.43
tournament	0.66
resources	0.77
challenge	0.55
invest	0.81
proud	0.82
outgrow	0.59

Note. This is the output of a principal component analysis with varimax rotation.

Section 6: Parent Investment by Time and Money, Separately

Table S12
Parents' Investment in Their Children by Type of Investment: Time, Money

	Parent Investment: Time			**Parent Investment: Money**		
Predictors	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*
(Intercept)	-0.05	0.07	0.433	-0.11	0.07	0.108
Girl	-0.02	0.10	0.865	-0.16	0.11	0.141
FAB	-0.08	0.05	0.151	-0.10	0.06	0.074
B=M	0.00	0.05	0.992	-0.08	0.05	0.093
Girl * FAB	0.08	0.09	0.348	-0.10	0.10	0.301
Girl * B=M	-0.10	0.06	0.106	0.03	0.07	0.649
FAB * B=M	0.01	0.03	0.670	0.06	0.03	0.088
Girl * FAB * B=M	0.05	0.05	0.305	0.00	0.05	0.934
	SD			*SD*		
Participant Random Intercept	0.81			0.80		
N	175			174		
Observations	229			227		
Marginal R^2 / Conditional R^2	0.023 / 0.887			0.066 / 0.859		

Note. Estimates (with standard error) and goodness-of-fit statistics for the two separate linear mixed effects models regressing parents' time and money investment in their children on their child's gender (Girl; girls = 1, boys = 0), their FAB (FAB), their "brilliance = men" stereotype (B=M), and all interactions with a random intercept for participant. All variables are mean-centered to allow for interpretation of lower-order effects.

Section 7: Reasons Why Parents' Other Children Do Not Play Chess

We assessed whether parents were more likely to encourage their sons than daughters to play chess, and whether such differential encouragement could be due to parents' biased belief that their daughters have lower chess ability or interest than their sons.

60 parents reported information about their non-chess-playing children; 88 parents reported having no non-chess-playing children; and 40 parents skipped the question about whether they had additional children who did not play chess.

In total, parents evaluated 80 of their non-chess-playing children (M_{age} = 22.2 years, Mdn_{age} = 21.5 years, SD_{age} = 11.4 years, 65% girls, 35% boys).[1] Girls were overrepresented among children who did not play chess (65% of all non-chess-playing children were girls), in stark contrast to their underrepresentation among children who did play chess (only 19% of all chess-playing children were girls), $p < 0.001$ on a test for equality of proportions. Non-chess-playing children were also older than chess-playing children, $t(112) = 2.21$, $p = .029$.

Parents were asked "Think about your child, [name], who does not play chess. Why do they not play chess? Please check all that apply." They were given the following options: a) too young, b) not interested in chess, c) low chess ability, and d) other, please explain. The explanations for the 6 instances of "other" responses were that the children had other things in their lives that they cared more about than playing chess competitively. We report how often these reasons were given for girls and boys in Tables S13, S15, S17, and S19 below.

We used logistic regressions to formally test whether the frequency of each of the four reasons differed for girls versus boys. In each of these models, the dependent variable was whether a particular reason was selected (= 1) or not (= 0), and the predictor was the non-chess-playing child's gender (0 = boy, 1 = girl). Because our sample size was small and some reasons were chosen infrequently, we used Firth's bias-reduced penalized-likelihood logistic regressions (Firth, 1993), implemented with the R package *logistf* version 1.24.1 (Heinze et al., 2013). We note that it is not currently possible to take into account the nested structure of a dataset (in our case, children are nested within parents) in a Firth's bias-reduced logistic regression. Thus, we were unable to account for dependencies within the data in these analyses.

The output of the four logistic regression models is displayed in Tables S14, S16, S18, and S20 below. The results revealed that parents used "too young" significantly more often when explaining why their sons (vs. daughters) do not play chess. In contrast, parents used "not interested" significantly more often for girls. A similar difference was observed for "low ability"—parents used this reason more often when explaining why girls (vs. boys) do not play chess—except this difference was not significant at conventional levels ($p = .068$).

References

Firth, D. (1993). Bias reduction of maximum likelihood estimates. *Biometrika, 80*(1), 27-38.

Heinze, G., Ploner, M., Dunkler, D., & Southworth, H. (2013). *Firth's bias reduced logistic regression*. R package version 1.24.1.

[1] Two additional nonbinary children were reported but could not be included in these analyses.

Table S13

The Frequency of "Too Young" as a Reason Why Girls versus Boys Do Not Play Chess

	Girls	**Boys**	**Proportion Girls**
"Too Young" Selected	3	11	21.4%
"Too Young" Not Selected	49	17	74.2%
Proportion "Too Young"	5.8%	39.3%	

Table S14

Firth's Bias-Reduced Penalized-Likelihood Logistic Regression Comparing the Frequency of "Too Young" as a Reason Why Girls versus Boys Do Not Play Chess

	Estimate	*SE*	Lower 95	Upper 95	χ^2	*p*
Intercept	-1.87	0.38	-2.74	-1.20	40.81	< .001
Girl	-2.23	0.67	-3.69	-1.00	13.29	< .001

Note. The predictor was mean-centered. Significance tests used the profile penalized log likelihood method.

Table S15

The Frequency of "Not Interested" as a Reason Why Girls versus Boys Do Not Play Chess

	Girls	**Boys**	**Proportion Girls**
"Not Interested" Selected	44	17	72.1%
"Not Interested" Not Selected	8	11	42.1%
Proportion "Not Interested"	84.6%	60.7%	

Table S16

Firth's Bias-Reduced Penalized-Likelihood Logistic Regression Comparing the Frequency of "Not Interested" as a Reason Why Girls versus Boys Do Not Play Chess

	Estimate	*SE*	Lower 95	Upper 95	χ^2	*p*
Intercept	1.20	0.28	0.71	1.80	23.97	< .001
Girl	1.24	0.53	0.20	2.31	5.48	.019

Note. The predictor was mean-centered. Significance tests used the profile penalized log likelihood method.

Table S17

The Frequency of "Low Ability" as a Reason Why Girls versus Boys Do Not Play Chess

	Girls	**Boys**	**Proportion Girls**
"Low Ability" Selected	6	0	100%
"Low Ability" Not Selected	46	28	62.2%
Proportion "Low Ability"	11.5%	0%	

Table S18

Firth's Bias-Reduced Penalized-Likelihood Logistic Regression Comparing the Frequency of "Low Ability" as a Reason Why Girls versus Boys Do Not Play Chess

	Estimate	*SE*	Lower 95	Upper 95	χ^2	*p*
Intercept	-2.69	0.57	-4.44	-1.81	68.76	< .001
Girl	2.80	1.49	-0.12	6.96	3.34	.068

Note. The predictor was mean-centered. Significance tests used the profile penalized log likelihood method.

Table S19

The Frequency of "Other" as a Reason Why Girls versus Boys Do Not Play Chess

	Girls	**Boys**	**Proportion Girls**
"Other" Selected	5	1	83.3%
"Other" Not Selected	47	27	63.5%
Proportion "Other"	9.6%	3.6%	

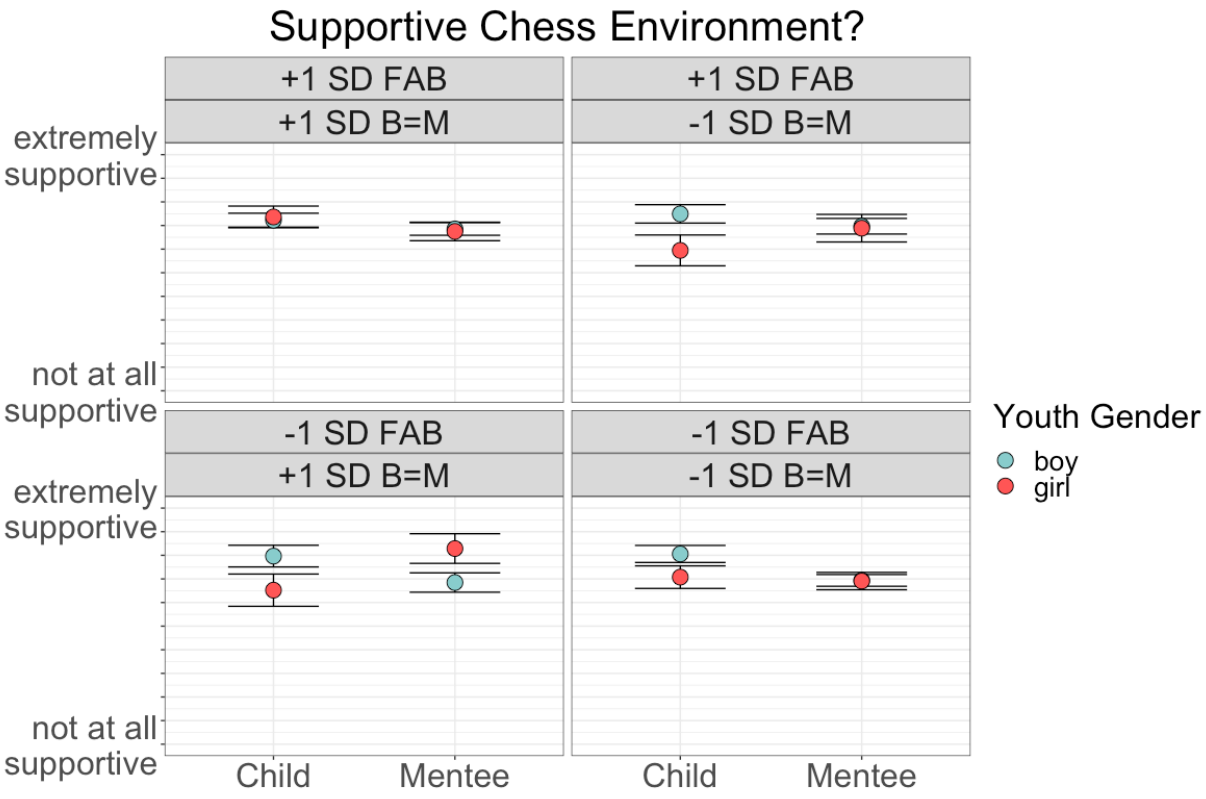
Table S20

Firth's Bias-Reduced Penalized-Likelihood Logistic Regression Comparing the Frequency of "Other" as a Reason Why Girls versus Boys Do Not Play Chess

	Estimate	*SE*	Lower 95	Upper 95	χ^2	*p*
Intercept	-2.42	0.41	-3.37	-1.69	66.03	< .001
Girl	0.75	0.95	-0.93	3.07	0.70	.403

Note. The predictor was mean-centered. Significance tests used the profile penalized log likelihood method.

Section 8: Four-way Interaction Predicting Ratings of Whether Youth Players' Environment is Supportive



Note. FAB = field-specific ability beliefs. B=M = "brilliance = men" stereotype.

Section 9: Parents' and Mentors' Investment in the First Youth Player They Reported on

We did not find any difference in investment based on youth gender in the analysis reported in the main text or the supplementary analyses reported in Sections 5 and 6 of this document. Because many parents and mentors reported on their investment in *multiple* youth players, it is possible that they felt uncomfortable admitting publicly that they treat their children (for parents) or mentees (for mentors) differently. If so, we might see more gender bias if we look just at the first youth player participants reported on. Thus, we examined whether there were differences in how much adults invested in the *first* child and/or mentee they reported on based on the youth player's gender.

In general, the results of this supplementary analysis corroborate those of the analyses with the full dataset: Parents and mentors invested similarly in female and male youth players (see Table S20). The only hint of bias uncovered by this supplementary analysis is that parents reported investing somewhat less money in their daughters than sons, but this effect did not reach significance, $b = -0.34$, $SE = 0.18$, $p = .066$ (see Table S21 for full model output).

Table S20

Linear Mixed-Effects Regressions: Parents' and Mentors' Investment in Youth Players (First Player Only)

	Parents			**Mentors**		
Predictors	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*
(Intercept)	−0.02	0.08	0.775	0.04	0.08	0.673
Girl (girl = 1, boy = 0)	−0.01	0.19	0.960	0.14	0.24	0.559
FAB	−0.13	0.08	0.089	−0.16	0.09	0.063
B=M	−0.04	0.08	0.661	−0.04	0.09	0.663
Girl × FAB	−0.15	0.18	0.427	−0.21	0.23	0.367
Girl × B=M	−0.04	0.17	0.792	−0.28	0.21	0.180
FAB × B=M	0.06	0.07	0.390	−0.09	0.08	0.292
Girl × FAB × B=M	0.05	0.15	0.714	−0.15	0.18	0.398
Observations	175			155		
Marginal R^2 / Conditional R^2	0.036 / -0.004			0.072 / 0.028		

Note. Estimates (with standard errors and *p* values) and goodness-of-fit statistics for the two separate linear models regressing parents' and mentors' investment in their first reported youth player on that youth player's gender (girl = 1, boy = 0), participants' field-specific ability beliefs (FAB), participants' "brilliance = men" stereotypes (B=M), and all interactions. Dichotomous variables are mean-centered. All other predictor and outcome variables are z-scored. This facilitates interpretation of lower-order effects. Coefficients can be interpreted as a one-unit (for dichotomous) or one *SD* (for continuous) change in predictor variables corresponding to the coefficient level change in the dependent variable.

Table S21

Parents' Investment in the First Child They Reported on, by Type of Investment: Time, Money

	Parent Investment: Time			**Parent Investment: Money**		
Predictors	*Estimate*	*SE*	*p*	*Estimate*	*SE*	*p*
(Intercept)	−0.01	0.08	0.884	−0.03	0.08	0.650
Girl (girl = 1, boy = 0)	0.15	0.19	0.443	−0.34	0.18	0.066
FAB	−0.08	0.06	0.201	−0.11	0.06	0.074
B=M	−0.00	0.06	0.953	−0.09	0.05	0.121
Girl * FAB	−0.06	0.15	0.676	−0.18	0.15	0.226
Girl * B=M	−0.03	0.12	0.784	0.08	0.12	0.465
FAB * B=M	0.01	0.04	0.752	0.07	0.04	0.105
Girl * FAB * B=M	0.04	0.09	0.610	-0.02	0.08	0.797
Observations	175			174		
Marginal R^2 / Conditional R^2	0.024 / -0.017			0.076 / 0.037		

Note. Estimates (with standard errors and *p* values) and goodness-of-fit statistics for the two separate linear models regressing parents' time and monetary investment in their first reported youth player on that youth player's gender (girl = 1, boy = 0), parents' field-specific ability beliefs (FAB), parents' "brilliance = men" stereotypes (B=M), and all interactions. Dichotomous variables are mean-centered. All other predictor and outcome variables are z-scored. This facilitates interpretation of lower-order effects. Coefficients can be interpreted as a one-unit (for dichotomous) or one *SD* (for continuous) change in predictor variables corresponding to the coefficient level change in the dependent variable.