

Supplementary Materials 1

Results from confirmatory analysis

Title: Math self-concept decreases while math anxiety increases over the lifespan

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Table S1. Data exclusion on participant and trial level

	children	younger adolescents	older adolescents	younger adults	middle- aged adults	older adults
	<i>N</i> = 53	<i>N</i> = 50	<i>N</i> = 50	<i>N</i> = 53	<i>N</i> = 50	<i>N</i> = 50
Exclusion of participants						
missing data	5	0	0	0	0	1
RT outlier in 3 MAD	1	2	0	0	3	1
ACC outlier (<25% correct)	9	1	0	0	0	2
n_excluded	15	3	0	0	3	4
Final sample	38	47	50	53	47	46
Exclusion of incomplete questionnaires						
math anxiety	2	1	0	0	0	0
math self-concept	0	0	0	0	0	1
Exclusion of trials						
incorrect response	31.62%	17.00%	10.81%	8.42%	8.73%	12.48%
RT < 200 ms	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
RT outlier	3.31%	4.12%	3.63%	3.30%	3.97%	4.48%

Table S2. Descriptive data for math self-concept, math anxiety and math performance

		<i>M</i>	<i>SD</i>	<i>Range</i>
Math self-concept	children	3.30	0.61	1.75 – 4.00
	younger adolescents	3.18	0.61	1.75 – 4.00
	older adolescents	3.10	0.68	1.50 – 4.00
	younger adults	2.98	0.78	1.50 – 4.00
	middle-aged adults	2.96	0.79	1.25 – 4.00
	older adults	2.74	0.93	1.00 – 4.00
	<i>overall</i>	3.03	0.76	1.00 – 4.00
Math anxiety	children	1.76	0.50	1.00 – 3.33
	younger adolescents	1.94	0.50	1.00 – 3.11
	older adolescents	1.94	0.53	1.00 – 3.11
	younger adults	2.16	0.71	1.00 – 3.56
	middle-aged adults	2.19	0.90	1.00 – 4.22
	older adults	2.39	1.04	1.00 – 5.00
	<i>overall</i>	2.08	0.75	1.00 – 5.00
Error rate	children	0.22	0.12	0.01 – 0.44
	younger adolescents	0.16	0.11	0.00 – 0.55
	older adolescents	0.11	0.08	0.02 – 0.35
	younger adults	0.08	0.04	0.01 – 0.19
	middle-aged adults	0.09	0.06	0.00 – 0.21
	older adults	0.10	0.08	0.00 – 0.38
	<i>overall</i>	0.12	0.09	0.00 – 0.55
Reaction time	children	10.43	3.98	3.58 – 21.85
	younger adolescents	7.17	2.74	3.79 – 15.20
	older adolescents	5.36	2.76	1.66 – 13.05
	younger adults	4.80	1.52	2.64 – 9.42
	middle-aged adults	5.04	1.45	2.56 – 8.93
	older adults	6.31	1.78	2.25 – 9.90
	<i>overall</i>	6.34	3.04	1.66 – 21.85

Figure S1. Relations between math self-concept and reaction time (A) and error rate (B) in each age group

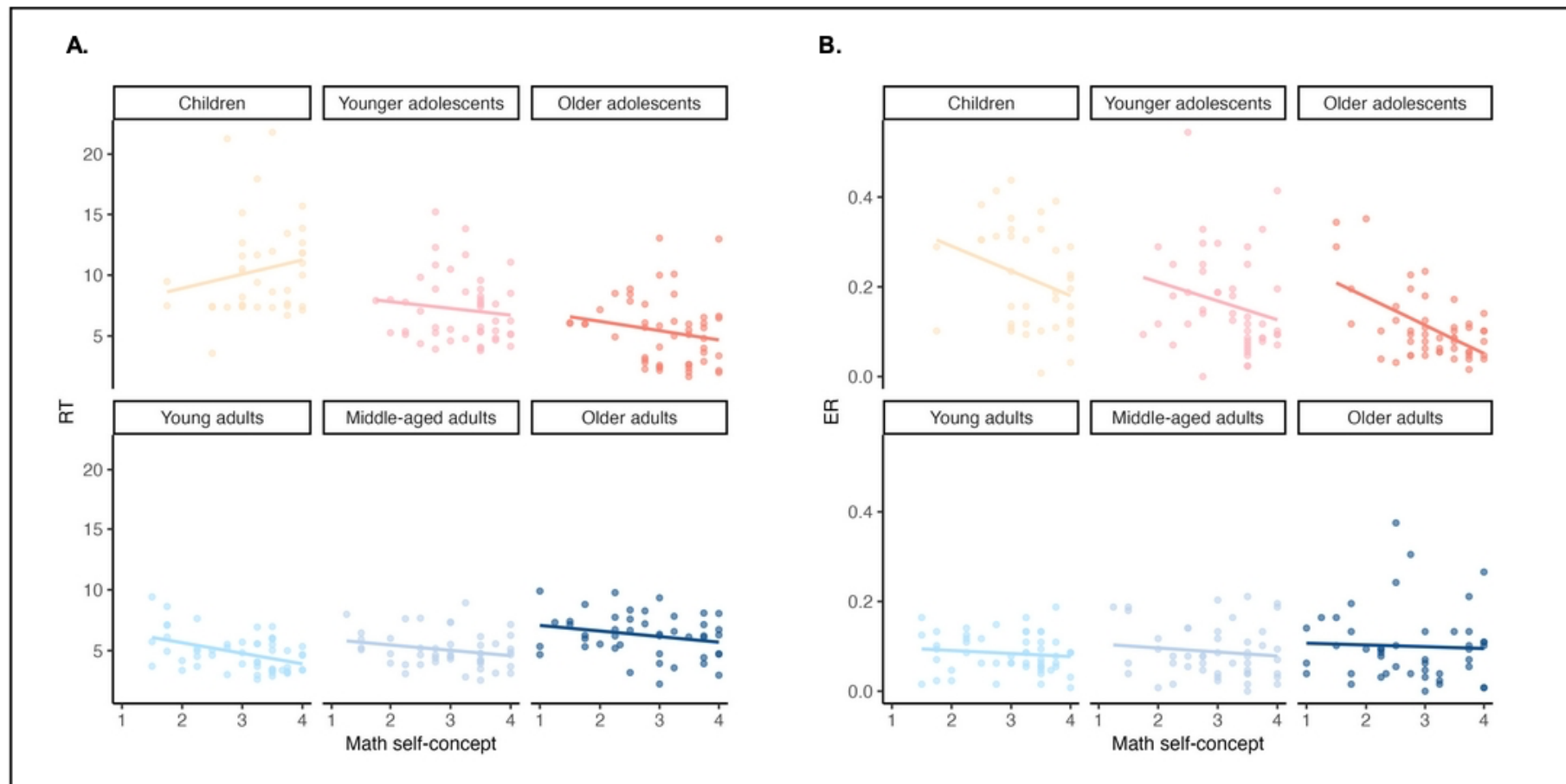


Figure S2. Relations between math anxiety and reaction time (A) and error rate (B) in each age group

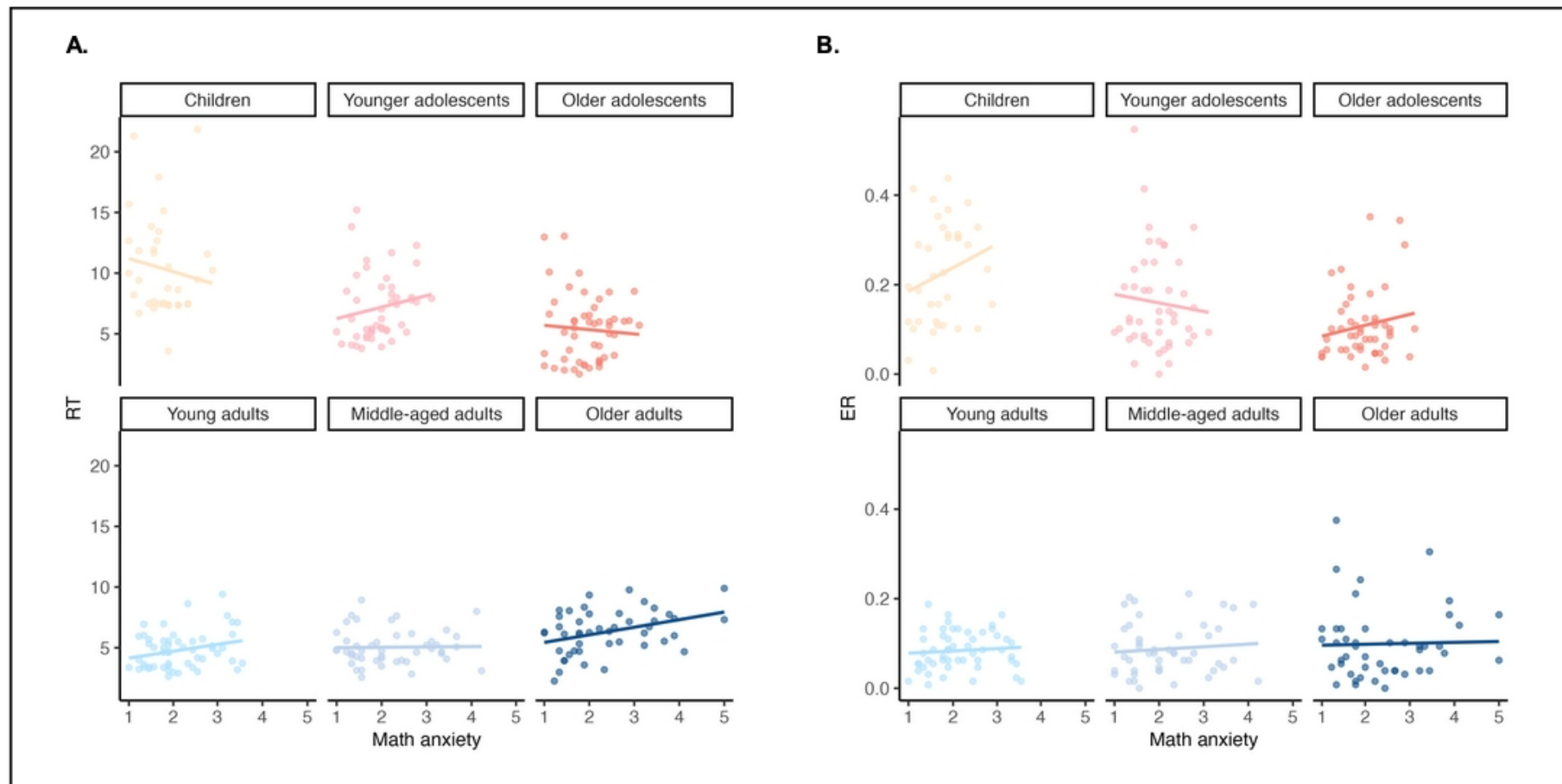


Table S3. Bayesian regression on math self-concept

(1) Model comparison for math self-concept

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	R^2
<i>Null model</i>	0.250	0.011	0.034	1.000	0.000
age group (linear)	0.083	0.439	8.623	> 100	0.050
age group (logarithmic)	0.083	0.251	3.693	67.224	0.036
age group (logarithmic) + age group (quadratic)	0.083	0.085	1.025	22.798	0.043
age group (linear) + age group (quadratic)	0.083	0.079	0.948	21.221	0.043
age group (linear) + age group (logarithmic)	0.083	0.077	0.917	20.587	0.043
age group (linear) + age group (logarithmic) + age group (quadratic)	0.250	0.056	0.178	4.981	0.043
age group (quadratic)	0.083	0.000	0.006	0.145	0.001

(2) Posterior summaries of coefficients

Coefficient	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	$BF_{inclusion}$	$Mean$	SD	95% Credible Interval	
								$Lower$	$Upper$
<i>Intercept</i>	1.000	0.000	1.000	0.000	1.000	3.034	0.044	2.950	3.126
age group (linear)	0.500	0.500	0.652	0.348	1.871	-0.059	0.085	-0.192	0.022
age group (logarithmic)	0.500	0.500	0.469	0.531	0.885	-0.240	0.551	-1.100	0.559
age group (quadratic)	0.500	0.500	0.221	0.779	0.284	-0.003	0.015	-0.045	0.016

Table S4. Bayesian ANOVA on math self-concept

(1) Model comparison

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	BF_{01}
<i>Null model</i>	0.500	0.361	0.566	1.000	
age group	0.500	0.639	1.766	1.766	0.566

(2) Analysis of effects

Effects	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	BF_{incl}	BF_{excl}
age group	0.500	0.500	0.639	0.361	1.766	0.566

Table S5. Bayesian regression on math anxiety

(1) Model comparison for math anxiety

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	R^2
<i>Null model</i>	0.250	0.001	0.004	1.000	0.000
age group (linear)	0.083	0.484	10.300	> 100	0.066
age group (logarithmic)	0.083	0.217	3.055	> 100	0.060
age group (linear) + age group (quadratic)	0.083	0.083	0.997	> 100	0.066
age group (linear) + age group (logarithmic)	0.083	0.082	0.984	> 100	0.066
age group (logarithmic) + age group (quadratic)	0.083	0.080	0.951	> 100	0.066
age group (linear) + age group (logarithmic) + age group (quadratic)	0.250	0.053	0.168	40.016	0.066
age group (quadratic)	0.083	0.000	0.000	0.152	0.001

(2) Posterior summaries of coefficients

Coefficient	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	$BF_{inclusion}$	$Mean$	SD	95% Credible Interval	
								<i>Lower</i>	<i>Upper</i>
<i>Intercept</i>	1.000	0.000	1.000	0.000	1.000	2.077	0.044	2.000	2.163
age group (linear)	0.500	0.500	0.702	0.298	2.352	0.079	0.086	0.000	0.211
age group (logarithmic)	0.500	0.500	0.432	0.568	0.760	0.214	0.553	-0.511	1.112
age group (quadratic)	0.500	0.500	0.216	0.784	0.275	0.003	0.014	-0.011	0.035

Table S6. Bayesian ANOVA on math anxiety

(1) Model comparisons

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	BF_{01}
Null model	0.500	0.190	0.081	1.000	
age group	0.500	0.810	12.404	12.404	0.081

(2) Analysis of effects

Effects	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	BF_{incl}	BF_{excl}
age group	0.500	0.500	0.925	0.075	12.404	0.081

(3) Post hoc comparisons

		Prior Odds	Posterior Odds	$BF_{10, U}$	error %
children	younger adults	0.260	2.219	8.535	0.000
	middle-aged adults	0.260	1.066	4.102	0.007
	older adults	0.260	6.471	24.895	0.000
older adults	younger adolescents	0.260	1.155	4.442	0.007
	older adolescents	0.260	1.250	4.809	0.006

Table S7. Bayesian ANCOVA on error rate

(1) Model comparison

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	error %
Null model	0.077	0.000	0.000	1.000	
age group + math self-concept	0.077	0.665	23.771	> 100	0.839
age group + math self-concept + math anxiety	0.077	0.172	2.499	> 100	0.871
age group	0.077	0.120	1.636	> 100	0.001
age group + math anxiety	0.077	0.035	0.441	> 100	1.083
age group + math self-concept + age group $\times$ math self-concept	0.077	0.005	0.059	> 100	1.049
age group + math self-concept + math anxiety + age group $\times$ math self-concept	0.077	0.002	0.021	> 100	5.112
age group + math self-concept + math anxiety + age group $\times$ math anxiety	0.077	0.000	0.009	> 100	5.912
age group + math anxiety + age group $\times$ math anxiety	0.077	0.000	0.002	> 100	5.287
age group + math self-concept + math anxiety + age group $\times$ math self-concept + age group $\times$ math anxiety	0.077	0.000	0.000	> 100	11.141

(2) Analysis of effects

Effects	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	BF_{incl}	BF_{excl}
age group	0.308	0.308	0.992	0.000	> 100	0.000
math self-concept	0.385	0.385	0.838	0.156	5.385	0.185
math anxiety	0.385	0.385	0.210	0.789	0.265	3.853
age group $\times$ math self-concept	0.231	0.231	0.007	0.838	0.008	> 100
age group $\times$ math anxiety	0.231	0.231	9.829×10^{-4}	0.210	0.005	> 100

Table S8. Bayesian ANCOVA on reaction time

(1) Model comparison

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	error %
<i>Null model</i>	0.077	0.000	0.000	1.000	
math self-concept + age group	0.077	0.453	9.927	> 100	0.764
age group	0.077	0.318	5.588	> 100	0.004
math anxiety + age group	0.077	0.103	1.380	> 100	1.382
math self-concept + math anxiety + age group	0.077	0.092	1.222	> 100	1.077
math self-concept + age group + math self-concept $\times$ age group	0.077	0.017	0.210	> 100	4.392
math self-concept + math anxiety + age group + math self-concept $\times$ age group	0.077	0.006	0.074	> 100	5.983
math self-concept + math anxiety + age group + math anxiety $\times$ age group	0.077	0.006	0.068	> 100	5.396
math anxiety + age group + math anxiety $\times$ age group	0.077	0.004	0.043	> 100	5.323
math self-concept + math anxiety + age group + math self-concept $\times$ age group + math anxiety $\times$ age group	0.077	0.002	0.018	> 100	8.943

(2) Analysis of effects

Effects	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	BF_{incl}	BF_{excl}
age group	0.308	0.308	0.966	0.000	> 100	0.000
math self-concept	0.385	0.385	0.551	0.424	1.298	0.754
math anxiety	0.385	0.385	0.202	0.788	0.256	3.945
age group $\times$ math self-concept	0.231	0.231	0.025	0.551	0.045	22.850
age group $\times$ math anxiety	0.231	0.231	0.011	0.202	0.053	18.878

Table S9. Bayesian ANCOVA on complexity effect (error rate)

(1) Model comparison

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	<i>error %</i>
Null model	0.077	0.009	0.105	1.000	
age group + math self-concept	0.077	0.622	19.765	71.906	1.114
math self-concept	0.077	0.147	2.064	16.958	0.004
age group + math self-concept + math anxiety	0.077	0.132	1.819	15.211	0.513
math self-concept + math anxiety	0.077	0.046	0.574	5.276	0.006
age group + math self-concept + math anxiety + age group $\times$ math anxiety	0.077	0.014	0.167	1.587	5.261
age group + math self-concept + age group $\times$ math self-concept	0.077	0.013	0.154	1.464	4.249
age group + math self-concept + math anxiety + age group $\times$ math self-concept	0.077	0.006	0.075	0.714	4.948
age group + math anxiety	0.077	0.005	0.057	0.549	0.894
age group	0.077	0.004	0.050	0.477	0.000

(2) Analysis of effects

Effects	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	BF_{incl}	BF_{excl}
age group	0.308	0.308	0.763	0.204	3.739	0.258
math self-concept	0.385	0.385	0.960	0.021	45.991	0.021
math anxiety	0.385	0.385	0.191	0.794	0.241	4.331
age group $\times$ math self-concept	0.231	0.231	0.019	0.768	0.025	41.920
age group $\times$ math anxiety	0.231	0.231	0.014	0.143	0.101	10.642

Table S10. Bayesian regression on complexity effect (error rate)

(1) Model comparison

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	R^2
Null model	0.278	0.002	0.004	1.000	0.000
age group (linear) + math self-concept	0.028	0.517	37.511	> 100	0.087
age group (linear) + math self-concept + age group (linear) $\times$ math self-concept	0.028	0.125	4.992	> 100	0.088
age group (linear) + math self-concept + math anxiety	0.028	0.115	4.568	> 100	0.088
age group (linear) + math self-concept + math anxiety + age group (linear) $\times$ math self-concept + age group (linear) $\times$ math anxiety	0.278	0.102	0.297	63.676	0.090
age group (linear) + math self-concept + math anxiety + age group (linear) $\times$ math self-concept	0.056	0.070	1.285	> 100	0.090
age group (linear) + math self-concept + math anxiety + age group (linear) $\times$ math anxiety	0.056	0.055	0.981	> 100	0.088
math self-concept	0.056	0.005	0.080	14.612	0.035
age group (linear) + math anxiety	0.028	0.004	0.131	23.185	0.051
age group (linear)	0.056	0.003	0.058	10.585	0.033

(2) Posterior summaries of coefficients

Coefficient	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	$BF_{inclusion}$	Mean	SD	95% Credible Interval	
								Lower	Upper
Intercept	1.000	0.000	1.000	0.000	1.000	0.254	0.025	0.206	0.298
age group (linear)	0.139	0.417	0.640	0.007	> 100	-0.039	0.060	-0.122	0.115
math self-concept	0.194	0.444	0.693	0.010	> 100	-0.128	0.039	-0.204	-0.058
math anxiety	0.194	0.444	0.190	0.652	0.667	-0.007	0.030	-0.095	0.040
age group (linear) $\times$ math self-concept	0.361	0.111	0.298	0.687	0.133	-0.005	0.014	-0.040	0.020
age group (linear) $\times$ math anxiety	0.361	0.111	0.158	0.189	0.256	-0.001	0.011	-0.028	0.017

Table S11. Bayesian ANCOVA on complexity effect (reaction time)

(1) Model comparison

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	error %
<i>Null model</i>	0.077	0.000	0.000	1.000	
age group	0.077	0.663	23.647	> 100	0.000
math self-concept + age group	0.077	0.132	1.819	> 100	0.942
math anxiety + age group	0.077	0.117	1.595	> 100	1.818
math anxiety + age group + math anxiety $\times$ age group	0.077	0.038	0.473	> 100	4.267
math self-concept + math anxiety + age group	0.077	0.027	0.338	> 100	1.026
math self-concept + math anxiety + age group + math anxiety $\times$ age group	0.077	0.016	0.199	> 100	5.129
math self-concept + age group + math self-concept $\times$ age group	0.077	0.004	0.045	> 100	4.790
math self-concept + math anxiety + age group + math self-concept $\times$ age group	0.077	0.001	0.015	> 100	6.783
math self-concept + math anxiety + age group + math self-concept $\times$ age group + math anxiety $\times$ age group	0.077	0.001	0.014	> 100	8.967

(2) Analysis of effects

Effects	P(incl)	P(excl)	P(incl data)	P(excl data)	BF_{incl}	BF_{excl}
age group	0.308	0.308	0.940	0.000	> 100	0.000
math self-concept	0.385	0.385	0.175	0.819	0.214	4.550
math anxiety	0.385	0.385	0.146	0.799	0.183	5.624
age group $\times$ math self-concept	0.231	0.231	0.006	0.175	0.035	30.930
age group $\times$ math anxiety	0.231	0.231	0.055	0.146	0.379	2.759

Table S12. Bayesian regression on complexity effect (reaction time)

(1) Model comparison

Models	$P(M)$	$P(M data)$	BF_M	BF_{10}	R^2
Null model	0.278	0.000	0.000	1.000	0.000
age group (linear)	0.056	0.553	21.014	> 100	0.116
age group (linear) + math self-concept + age group (linear) $\times$ math self-concept	0.028	0.096	3.705	> 100	0.133
age group (linear) + math self-concept + math anxiety + age group (linear) $\times$ math self-concept + age group (linear) $\times$ math anxiety	0.278	0.070	0.197	> 100	0.135
age group (linear) + math anxiety + age group (linear) $\times$ math anxiety	0.028	0.067	2.528	> 100	0.130
age group (linear) + math self-concept	0.028	0.067	2.522	> 100	0.119
age group (linear) + math anxiety	0.028	0.056	2.085	> 100	0.118
age group (linear) + math self-concept + math anxiety + age group (linear) $\times$ math self-concept	0.056	0.043	0.759	> 100	0.133
age group (linear) + math self-concept + math anxiety + age group (linear) $\times$ math anxiety	0.056	0.035	0.614	> 100	0.132
age group (linear) + math self-concept + math anxiety	0.028	0.013	0.452	> 100	0.119

(2) Posterior summaries of coefficients

Coefficient	$P(incl)$	$P(excl)$	$P(incl data)$	$P(excl data)$	$BF_{inclusion}$	Mean	SD	95% Credible Interval	
								Lower	Upper
Intercept	1.000	0.000	1.000	0.000	1.000	1808.089	75.088	1666.404	1945.101
age group (linear)	0.139	0.417	0.689	0.000	> 100	-232.876	209.301	-584.967	300.552
math self-concept	0.194	0.444	0.115	0.676	0.388	-19.778	74.677	-237.859	81.462
math anxiety	0.194	0.444	0.112	0.716	0.357	-9.721	79.139	-211.447	150.781
age group (linear) $\times$ math self-concept	0.361	0.111	0.209	0.115	0.559	-22.704	54.712	-162.157	0.000
age group (linear) $\times$ math anxiety	0.361	0.111	0.173	0.112	0.475	17.241	49.611	0.000	150.915