Supplementary Online Materials

First, we report measures, methods, and results for our supplementary model with advanced STEM course-taking in high school. Second, we report our supplemental test of mediation for both our primary and supplementary models. Appendices with tables and figures referenced in the manuscript and in the supplemental analyses reported here are included at the end.

(1) Supplementary Model: Advanced STEM Course-Taking in High School

The supplementary model is the same as the primary model reported in the manuscript, except we replaced our measure of all high school STEM course-taking during 11^{th} and 12^{th} grade taken from high school transcripts with self-reported advanced STEM course-taking in high school. We did this for two reasons: (1) because these advanced courses are particularly predictive of later successes, including college major and graduation (e.g., Trusty, 2002) and (2) because of the variability in mathematics and science course titles from over the 100 different high schools the students from our sample attended necessitated the use of these self-report variables in order to best understand if students took specific advanced courses.

Methods

Measures

Self-reported advanced STEM course-taking in high school was assessed by asking students after high school graduation if they completed any of the following courses: calculus, pre-calculus, trigonometry, algebra II, and physics. The total number of these courses was summed to create the final measure of advanced STEM course-taking in high school.

Analysis Plan

The supplementary structural equation model (SEM) was estimated to investigate the relationship between SES, the mediators, and the outcomes (high school and college STEM course-taking) in a single model. In the model, all variables at one time point were allowed to correlate and also predict all variables at subsequent time points. As a reminder, this supplementary analyses included an identical model to our primary model reported in the manuscript with one difference: advanced STEM course-taking in high school as a replacement for general high school STEM course-taking since prior research suggests advanced high school mathematics and physics are particularly important predictors of STEM choices in the future (e.g., Trusty, 2002). In this model, we also examined if the total indirect effect of the parental education on high school and college course-taking through all the motivational and identity variables was significant (Preacher & Hayes, 2008). Missing data was accounted for by using full information maximum likelihood methods (Arbuckle, 1996).

Results

Direct and Indirect Effects of Supplementary Model

See Appendix C for the all the direct effects (significant and non-significant), Appendix D the accompanying path model, and Appendix E for an indirect effects table. There was a significant zero-order direct effect of parental education on advanced mathematics and science course-taking ($r = .27$, $p < .01$). The total indirect effect of parental education on advanced high school STEM course-taking ($z = 2.70$, $p <.01$, $\beta = .07$) and college STEM course-taking ($z = 3.01$, $p < .01$, $\beta = .13$) were significant. A similar total indirect effect was found for STEM-dependent/-independent future identities on college STEM course-taking ($z = 3.76$, $p < .001$, $\beta = .14$).

Supplemental Tests of Mediation for Primary and Supplementary Models

Although a significant indirect effect is strong evidence for mediation which we find evidence for in both our primary and supplementary models (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002), another way to test for mediation is to compare two models: one with the direct effects of parental education on high school and college STEM course-taking (direct effects model) and another without the direct effects (indirect effects only model). This is a test of mediation because if the indirect effects only model is a better fit to the data, that suggests that the direct effects are not necessary to include in the model, which can be taken to mean that the direct effects are mediated through the indirect effects.

For our primary model reported in the manuscript, when testing this for all STEM courses, we found that both models had relative equivalent fits to the data, as shown by having a similar sample-size adjusted Bayesian information criterion (BIC) and Akaike information criterion (AIC) fit statistics (indirect effects only model: BIC = 7758, AIC = 7531; direct effects model: BIC = 7757, AIC = 7529). The similarity in fit indices between models suggests that some but not all of the direct effect of parental education goes through the set of mediators measured in the current study. When testing the supplementary model with just advanced high school STEM courses, we found that the indirect effects model had a similar fit as compared to the direct effects model, as shown by the (sample-size adjusted BIC and AIC) fit statistics (indirect effects only model: BIC = 7181, AIC = 7154; direct effects model: BIC = 7173, AIC = 7146). Altogether, our supplemental tests of mediation between direct effects and indirect effects only models across both our primary and supplementary models suggests that some but not all of the direct effect of parental education goes through the set of mediators measured in the current study.

References

Arbuckle, J. L. (1996). Full information estimation in the presence of incomplete data. *Advanced Structural Equation Modeling: Issues and Techniques*, *243*, 277.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, *7*, 83. http://dx.doi.org/10.1037/1082-989X.7.1.83

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*, 879-891. doi:10.3758/BRM.40.3.879

Trusty, J. (2002). Effects of high school course-taking and other variables on choice of science and mathematics college majors. *Journal of Counseling and Development: JCD*, *80*, 464.

Appendices

Appendix A. All direct effects for the primary model (high school STEM course-taking).

Direct Effects	z	β
Middle School		
Mothers’ aspirations for their student in mathematics		
Parental education	2.34*	.15
Students’ expectations for their success in mathematics		
Parental education	2.19*	.14
Students’ value for mathematics		
Parental education	1.55	.10
High School		
Students’ STEM-dependent/independent future identities		
Parental education	0.49	.03
Mothers’ aspirations for their student in mathematics	2.78*	.21
Students’ expectations for success in mathematics		
Students’ value for mathematics	2.12*	.16
High school STEM course-taking	-0.53	-.04
Parental education		
Mothers’ aspirations for their student in mathematics	2.24*	.13
Students’ expectations for success in mathematics	2.48*	.17
Students’ value for mathematics		
Students’ STEM-dependent/independent future	1.58	.11
identities	-0.77	-.05
	2.94*	.19
Post-High School		
Parents’ STEM utility value for their student		
Parental education	2.61*	.15
High school STEM course-taking	4.83*	.29
Students’ expectations for success in mathematics	-0.52	-.04
Students’ value for mathematics	1.47	.09
Mothers’ aspirations for their student in mathematics	1.08	.07
Students’ STEM-dependent/independent future identities	2.55*	.17
Students’ STEM value		
Parental education		
High school STEM course-taking	-0.64	-.04
	4.20*	.25
Students’ expectations for success in mathematics	2.75*	.18
Students’ value for mathematics	2.35*	.14
Mothers’ aspirations for their student in mathematics	0.90	.06
Students’ STEM-dependent/independent future identities	3.52*	.23

Direct Effects (cont'd)	z	β
College		
College STEM course-taking		
Parental education	1.21	.08
Students' expectations for success in mathematics	1.59	.12
Students' value for mathematics	-1.20	-.08
Mothers' aspirations for their student in mathematics	-0.41	-.03
Students' STEM-dependent/independent future identities	2.13*	.14
High school STEM course-taking	1.86	.15
Parents' STEM utility value for their student	3.95*	.28
Students' STEM value	2.93*	.22
College STEM career aspirations		
Parental education	-0.99	-.07
Students' expectations for success in mathematics	-0.17	-.01
Students' value for mathematics	-0.28	-.02
Mothers' aspirations for their student in mathematics	-0.50	-.04
Students' STEM-dependent/independent future identities	1.49	.11
High school STEM course-taking	2.50*	.19
Parents' STEM utility value for their student	-0.16	-.01
Students' STEM value	4.93*	.39

Note. N = 272. * = p < .05 level.

Appendix B. Significant individual indirect effects of parental education and STEM-dependent/independent future identities to high school and college STEM course-taking in the primary model.

Indirect Effects	z	B
Parental education → parents' STEM utility value for their student → college STEM course-taking	2.17*	.04
STEM-dependent/independent future identities → students' STEM value → college STEM course-taking	2.24*	.05
STEM-dependent/independent future identities → parents' STEM utility value for their student → college STEM course-taking	2.17*	.05
STEM-dependent/independent future identities → high school STEM course-taking parents' → parents' STEM utility value for their student → college STEM course-taking	2.12*	.02

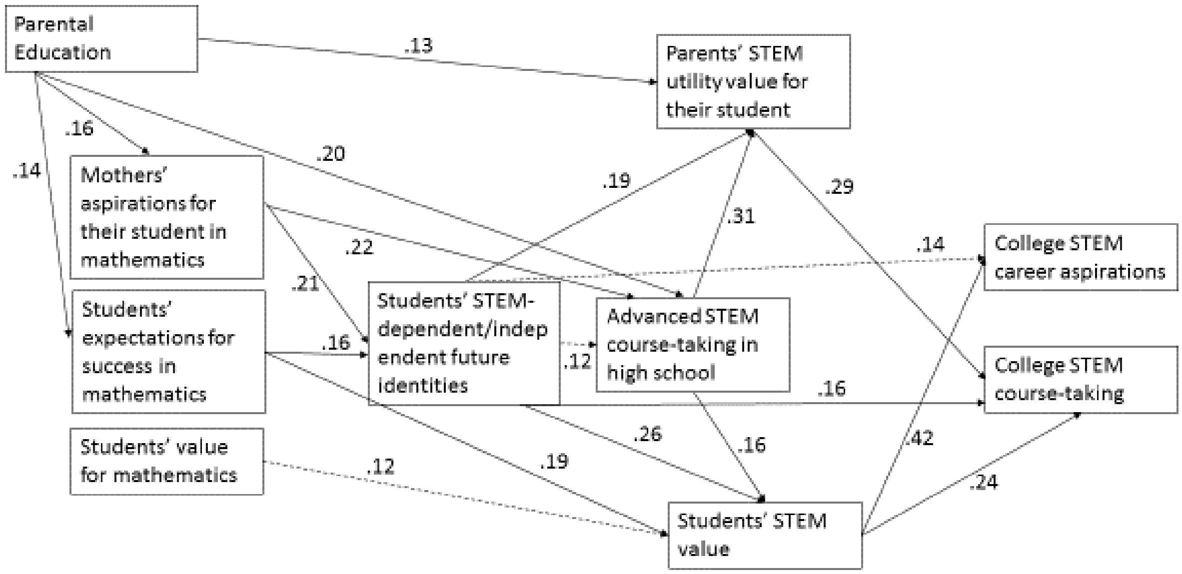
Note. * = p < .05 level. Only significant individual indirect effect paths from the primary model are reported.

Appendix C. All direct effects for the supplementary model (advanced STEM course-taking).

Direct Effects	z	β
Middle School		
Mothers' aspirations for their student in mathematics		
Parental education	2.49*	.16
Students' expectations for their success in mathematics		
Parental education	2.29*	.14
Students' value for mathematics		
Parental education	1.62	.10
High School		
Students' STEM-dependent/independent future identities		
Parental education	0.40	.03
Mothers' aspirations for their student in mathematics	2.81*	.21
Students' expectations for success in mathematics	2.11*	.16
Students' value for mathematics	-0.54	-.04
Advanced STEM course-taking in high school		
Parental education	3.42*	.20
Mothers' aspirations for their student in mathematics	3.37*	.22
Students' expectations for success in mathematics	1.75	.12
Students' value for mathematics	1.63	.10
Students' STEM-dependent/independent future identities	1.85	.12
Post-High School		
Parents' STEM utility value for their student		
Parental education	2.19*	.13
Advanced STEM course-taking in high school	4.62*	.31
Students' expectations for success in mathematics	-0.59	-.04
Students' value for mathematics	0.88	.06
Mothers' aspirations for their student in mathematics	0.55	.04
Students' STEM-dependent/independent future identities	2.78*	.19
Students' STEM value		
Parental education	-0.65	-.04
Advanced STEM course-taking in high school	2.54*	.16
Students' expectations for success in mathematics	2.75*	.19
Students' value for mathematics	1.87	.12
Mothers' aspirations for their student in mathematics	0.89	.06
Students' STEM-dependent/independent future identities	3.92*	.26

Direct Effects (cont'd)	z	β
College		
College STEM course-taking		
Parental education	1.10	.07
Students' expectations for success in mathematics	1.58	.12
Students' value for mathematics	-1.50	-.10
Mothers' aspirations for their student in mathematics	-0.26	-.02
Students' STEM-dependent/independent future identities	2.38*	.16
Advanced STEM course-taking in high school	1.48	.10
Parents' STEM utility value for their student	4.06*	.29
Students' STEM value	3.26*	.24
College STEM career aspirations		
Parental education	-0.82	-.06
Students' expectations for success in mathematics	0.02	.00
Students' value for mathematics	-0.43	-.03
Mothers' aspirations for their student in mathematics	-0.08	.00
Students' STEM-dependent/independent future identities	1.82	.14
Advanced STEM course-taking in high school	0.19	.01
Parents' STEM utility value for their student	0.30	.02
Students' STEM value	5.34*	.42

Note. N = 272. * = $p < .05$ level.


Parental Education
Parents' STEM utility value for their student
Mothers' aspirations for their student in mathematics
Students' expectations for success in mathematics
Students' STEM-dependent/independent future identities
Advanced STEM course-taking in high school
College STEM career aspirations
College STEM course-taking
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Appendix D. Supplementary Empirical Path Model. Significant paths are shown in solid lines. Dashed lines are $p < .10$. The relationship between parental education on advanced STEM course-taking in high school and college STEM course-taking are mediated by mothers' aspirations for their student in mathematics, students' expectations for success in mathematics, students' value for mathematics, students' STEM-dependent/independent future identities, parents' STEM utility value for their student, and students' STEM value. Numbers represent standardized beta weights, and although all pathways are included in the model, only significant pathways are displayed in the path model.

Appendix E. Association between Parental Education, Students' STEM-Dependent/-Independent Future Identities, and STEM Educational Outcomes for the Supplementary Model.

	Zero-Order Effects	Effects with Mediating Variables in the Model	Change in Standardized Estimate	Change in Effect (%)	Significant Indirect Effect
Predictor: Parental Education					
College STEM Course-Taking	0.20**	0.07	0.13	65%	Yes
Advanced STEM Course-Taking in High School	0.27**	0.20**	0.07	26%	Yes
Predictor: Students' STEM Future Identities					
College STEM Course-Taking	0.37*	0.16*	0.21	57%	Yes

Note. Direct effects of parental education on outcome variables without mediators (i.e., the correlation between parental education and STEM course-taking outcomes), direct effects with mediating variables in the model, the change in effect between the two models, the percentage change, and if the indirect effect is significant for both models. The same is reported for students' STEM future identities. For first three columns, numbers are standardized coefficients from the SEM. All indirect effects reported are significant. * = $p < .05$, ** $p < .01$ refer to the significance level of the zero-order effects and effects with mediating variables in the model.