Malleable Minds:
The effects of STEM- v. humanities-focused curricula

Robert Ainsworth[1]
Rajeev Dehejia[2]
Andrei Munteanu[3]
Cristian Pop-Eleches[4]
Miguel Urquiola[4]

[1]U Florida [2]NYU [3]U Québec in Montréal & Harvard CID [4]Columbia

Motivation

- What are the benefits/costs of focusing on STEM or humanities subjects in high school?
- This question is explored in a growing literature

  Altonji 1995; Rose and Betts 2004; Joensen and Nielsen 2009, 2014; Cortes, Goodman, and Nomi 2015; Darolia et al. 2020; De Phillipis 2021; Cohodes, Ho, and Robles 2022; Dahl, Rooth, and Stenberg 2023; Liu, Conrad, and Blazar 2024

- Two main findings:
  1. What students study in h.s. affects what they study in college and what careers they pursue
  2. Focusing on STEM in high school has labor market returns

Open questions

1. What are the mechanisms by which high school curricular focus affects educational and career trajectories?
   - Inertia and sunk costs? Or impacts on what a student likes and feels good at?
2. Is there substantial heterogeneity?
   - Some students could be "mismatched" to STEM (or humanities)
3. What are the effects on wellbeing and school satisfaction?
4. What are the effects on non-labor market outcomes, such as social and civic outcomes?
   - Arguments in favor of hum. often center on effects on this front e.g., Nussbaum 2010

   $\rightarrow$ Claim that hum. develops self-awareness, social perceptiveness, moral reasoning, ...

This paper: tackle Questions (1)-(4)

- Analyze the Romanian high school system
- In Romania, high school options come with a curricular focus (akin to a college major)
- Consider the impacts of a STEM v. humanities or social studies curricular focus (HSS)
- The student allocation mechanism creates an RD in assignment to STEM or HSS
- Administrative and survey data lets us estimate impacts on:
  - high school performance; college enrollment; career plans; beliefs about own abilities; preferences over academic subjects and job tasks; wellbeing and school satisfaction; friendships; time use; expectations; political views

Malleable minds

1. Large effects on educational pathways and career plans
2. STEM is riskier and harder
   - For low-achievers, STEM ↑'s the chance of failing a high school exit exam, ↓'s the probability of attending college, ↑'s time spent on homework. For boys, STEM ⇒ higher self-reported grit
3. Mechanisms: large effects on what students like and think they're good at
   - Less evidence for other channels (e.g., sunk costs)
4. Modest impacts on wellbeing and school satisfaction
   - STEM ↑'s these in high school, has mixed effects a year later
   - Causes low-achievers to be less happy with their high school appl. choices by a year later
5. Effects on social and civic outcomes, but mainly for boys
   - STEM makes boys have fewer friendships with girls, spend less time reading, and hold more traditionalist expectations and right-wing political views

Setting and data

Setting: Romania's public high schools

1. Tracks:
   - Are stand-alone units within schools
   - Three broad types: STEM, HSS, and Technical
   - Hours of instruction vary significantly across curricula

2. Choice:
   - Students take a national, standardized **high school transition exam**
   - Submit a **rank-ordered list of preferences** over high school tracks
     - Virtually limitless
     - No geographic restrictions

3. Centralized allocation:
   - Based on **transition score**, mean of:
     - Grade 5-8 GPA & transition exam score
   - Mechanism: **serial dictatorship** with high-transition score students prioritized

     $\rightarrow$ Truthful revelation & minimum transition score **cutoffs** for each track

Data: administrative data

- For the 2015-2019 entering cohorts in 16/41 counties, we observe:

1. High school admission data:
   - Transition score: Grade 5-8 GPA, scores on admission exam components
   - Choices: students' ranked choices over tracks
   - Allocation: final assignment of students to tracks

2. High school enrollment data:
   - Enrollment histories at the school-track-classroom level

3. High school achievement data:
   - Graduation
   - Scores on national, standardized, curriculum-specific exam (**Baccalaureate**)

Data: surveys

1. In-class survey one month before high school graduation (May 2023)
   - 10,267 students in 292 high schools, 94 towns
     - College plans
     - Beliefs about own abilities
     - School experience, friends, time use, wellbeing, future expectations, political views
2. Follow-up phone surveys 1-1.5 years after high school (May 2024, October 2024)
   - 2,051 and 3,013 students (from those in the first survey)
     - Performance on the bacc. exam
     - College enrollment (or current employment)
     - Preferences over high school and college subjects, beliefs about own abilities
     - Career plans and preferences (O*NET)
     - High school and college experience/regret, time use, wellbeing, political preferences

Empirical strategy

Strategy: a regression discontinuity design

$\rightarrow$ Compare students on either side of cutoffs that separate STEM and HSS tracks

- Two types of cutoffs:
  1. STEM-above: student ranks a STEM track above a HSS track:
     - Scores above (below) the cutoff $\rightarrow$ STEM (HSS)
  2. STEM-below: student ranks a HSS track above a STEM track:
     - Scores above (below) the cutoff $\rightarrow$ HSS (STEM)
- We are interested in the effect of curriculum, **not** of going to a better track

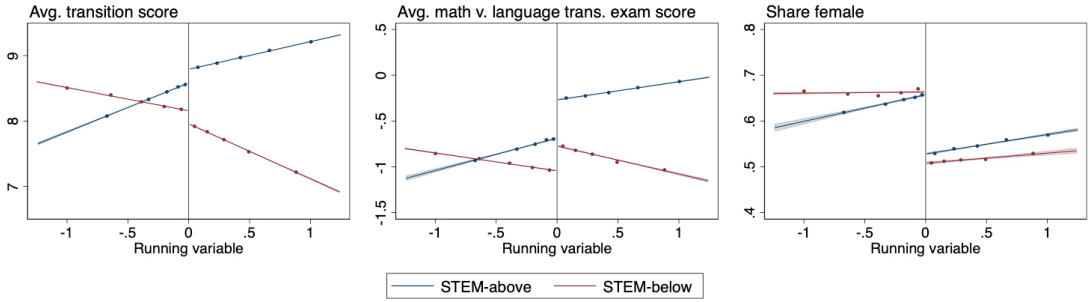
$\Rightarrow$ Set r. variable r_i for student with score t_i to be $+$ **on the STEM side** of the cutoff c_j:

- STEM-above: $r_i = t_i - c_j$
- STEM-below: $r_i = c_j - t_i$

Strategy, continued

- We estimate separate treatment effects of STEM assignment for STEM-above (α_S) and STEM-below (α_H) cutoffs
- To do so, we can run separate RDs with typical controls: (equation)
  - cutoff fixed effects + linear splines in the running variable
- We then compute the effect of STEM assignment as the simple average of α_S and α_H
  - This nets out the effect of assignment to a better track
- Use the Delta Method to calculate s.e.'s, clustered by student and cutoff

Treatments: Effects on attributes of students' assigned tracks



- ATE of STEM assignment: the avg. of the blue and red gaps at the cutoff

$\rightarrow$ ATE is 0 for peer quality, but not for peer math v. lang. strength or share female

What we measure...

What sub-treatments are embedded in our RD TE?

(a) ✓ a different curriculum

- courses, teachers, etc.

(b) X scoring above/below a cutoff

- having higher/lower achieving peers, being the lowest-/higher-achieving student in the track

(c) ✓ different types of peers

- gender composition, relative ability in math v. language

The first stage

Q: Does being assigned to STEM v. HSS affect what students actually study in high school?

- Answer this using administrative data on high school enrollment and graduation

Effects on high school enrollment and graduation

	Years enrolled			Graduate		
	All	STEM	HSS	All	STEM	HSS
STEM	0.002	3.08***	-3.09***	-0.003	0.694***	-0.703***
	(0.007)	(0.023)	(0.023)	(0.003)	(0.007)	(0.008)
Intercept	3.91	0.50	3.36	0.96	0.16	0.80
N	55,221	55,221	55,221	55,221	55,221	55,221

- STEM assignment doesn't affect overall years of enrollment or graduation
- But ↑'s STEM enrollment and graduation: strong first stage
- Little heterogeneity

Educational pathways and career plans

Q: Does h.s. curricular focus affect students' trajectories?

- In surveys, asked students about their:
  - plans for/enrollment in college
  - plans for careers

Effects on educational pathways

	Any	**STEM**				**Hum., law, & social science**				**Other/ unsure**
		Any	Math & CS	Medicine	Economics & Bus.	Any	Humanities	Law	Social science	
College plans at the end of high school										
STEM	0.010	0.233***	0.147***	0.041*	0.046*	-0.224***	-0.075***	-0.057***	-0.092***	0.001
	(0.018)	(0.035)	(0.024)	(0.024)	(0.027)	(0.032)	(0.020)	(0.021)	(0.020)	(0.023)
Intercept	0.87	0.31	0.08	0.10	0.14	0.39	0.13	0.12	0.14	0.16
N	3,987	3,987	3,987	3,987	3,987	3,987	3,987	3,987	3,987	3,987
College enrollment one year after high school										
STEM	-0.037	0.246***	0.192***	0.015	0.039	-0.261***	-0.123***	-0.092***	-0.046***	-0.022
	(0.025)	(0.036)	(0.031)	(0.022)	(0.026)	(0.031)	(0.021)	(0.021)	(0.017)	(0.027)
Intercept	0.82	0.28	0.11	0.08	0.10	0.38	0.17	0.13	0.08	0.16
N	3,327	3,327	3,327	3,327	3,327	3,327	3,327	3,327	3,327	3,327

- STEM assignment ↑'s (↓'s) STEM (HSS) plans and enrollment: little heterogeneity

Effects on career plans one year after high school

	STEM				Art, education, law, and social services	Other/ unsure
	Any	Tech & engineering	Medicine	Economics & Business		
STEM	0.173*** (0.056)	0.254*** (0.051)	-0.041 (0.044)	-0.040 (0.063)	-0.145*** (0.046)	-0.028 (0.040)
Intercept	0.60	0.10	0.17	0.33	0.23	0.17
N	1,159	1,159	1,159	1,159	1,159	1,159

- STEM ↑'s plans for tech & engineering careers; ↓'s plans for HSS-related careers
- Not much heterogeneity

Risk and difficulty

Q: Does h.s. curric. focus affect whether students achieve their goals/how hard they work?

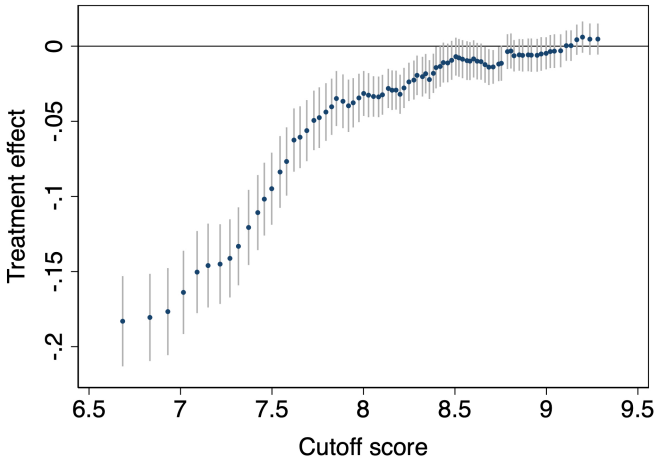
- Using admin. data, examine effects on performance on the baccalaureate exam
- Using survey data, examine effects on questions related to risk and difficulty

Effects on performance on the baccalaureate exam

	Take the exam	**Pass the exam**	**Exam score**	**Pass in** STEM	**Pass in** HSS
STEM	-0.011*** (0.003)	-0.036*** (0.004)	-0.351*** (0.015)	0.642*** (0.008)	-0.686*** (0.008)
Intercept	0.95	0.92	8.08	0.14	0.77
Std. dev.	0.21	0.29	1.21	0.50	0.49
N	73,470	73,470	69,938	55,221	55,221

- STEM assignment $\Rightarrow$ less likely to take/pass the exam; lower score conditional on taking
- But more likely to pass in STEM

Effects on passing the baccalaureate exam by cutoff score



- Effects on passing are strongly negative for low-achievers (those at less selective cutoffs; 11 pp) and small for high-achievers
- Effects on exam score are sizable and negative for everyone

Other results

STEM assignment $\Rightarrow$

1. Low-achievers are 9 pp less likely to be enrolled in college a year after high school
2. Low-achievers spend an additional 0.5 hours per weekday on homework during high school
3. Male students report higher grit at the end of high school
4. Students believe their bacc. exam is especially hard

Mechanisms

Q: What drives the effects of h.s. curricular focus on student trajectories?

- In surveys, asked students to:
  - Score their abilities in/preferences for academic subjects on a scale of 1-5
  - Complete an O*NET Job Interest Profiler
  - Score representative jobs on quality dimensions on a scale of 1-5
  - Select attributes they consider when choosing college/a job

Effects on beliefs about own high school abilities

	STEM subjects	Humanities subjects	Social studies subjects
Confidence at the end of high school			
STEM	0.873***	-0.235***	-0.565***
	(0.077)	(0.064)	(0.074)
Intercept	2.60	4.07	3.98
Std. dev.	1.29	0.90	1.15
N	3,987	3,987	3,987
Confidence one year after high school			
STEM	0.744***	-0.267***	-0.745***
	(0.124)	(0.087)	(0.139)
Intercept	2.96	4.20	4.06
Std. dev.	1.10	0.84	1.13
N	1,159	1,159	1,159

- STEM assignment ↑'s (↓'s) confidence in STEM (HSS) abilities for h.s. subjects
- Little heterogeneity

Effects on preferences for high school subjects

	STEM subjects	Humanities subjects	Social studies subjects
Preferences one year after high school			
STEM	1.01*** (0.151)	-0.405*** (0.102)	-0.697*** (0.135)
Intercept	2.72	4.13	4.08
Std. dev.	1.37	1.04	1.21
N	1,159	1,159	1,159

- STEM assignment ↑'s (↓'s) preferences for STEM (HSS) h.s. subjects
- Little heterogeneity
- Belief and preference results for college subjects are similar

Other results

- STEM assignment changes which job tasks students enjoy
  - And makes O*NET 10 pp more likely to recommend a STEM job
- For a few representative jobs, STEM assignment doesn't affect beliefs about earnings or work conditions. But influences liking the work content and feeling prepared
- When asked to explain how they choose college/a job, students report caring about what matches their abilities and interests
  - Relatively few say they are influenced by sunk costs or peers/teachers

Wellbeing and satisfaction

Q: Do students enjoy STEM or HSS more, and does this vary by student attributes?

- In surveys, asked students to:
  - Complete a wellbeing questionnaire
  - Score attributes of high school and college on a scale of 1-5
  - Reveal their contentment with their high school/college application choices

Effects on wellbeing and high school satisfaction at the end of high school

	Well-being	**Liked the high school:**				**H.s. curric. was good fit**
		Experience	Curriculum	Peers	Teachers	
STEM	0.133***	0.113*	0.002	0.233***	-0.022	0.001
	(0.051)	(0.068)	(0.066)	(0.072)	(0.068)	(0.053)
Intercept	-0.14	3.69	3.32	3.53	3.60	3.39
Std. dev.	0.74	0.99	1.04	1.12	1.02	0.86
N	3,987	3,987	3,987	3,987	3,987	3,987

- At the end of high school, STEM assignment ↑'s wellbeing and high school satisfaction and doesn't affect whether students' found the curriculum to be a good fit
- Little heterogeneity
- The wellbeing effects may be connected to a ↓ in time spent on social media

Other results

By a year after high school, STEM assignment

- Has no effect on wellbeing and mixed impacts on high school satisfaction
- Makes low-achievers less happy with their high school application choices
- Makes students like college less but not like their college application choices less

Social and civic outcomes

Q: What are the effects of STEM versus HSS on these?

- In surveys, asked students:
  - How many friends they have
  - How much time they spend on different activities on a typical weekday
  - What they expect their life and family structure to be like at age 30
  - Whether they agree with statements on politically charged issues

Effects on social and civic outcomes at the end of high school

	Number of friends			Hours spent reading	Tradionalist expectations	Right-wing political views
	Good	Very close	Female v. male			
Male students						
STEM	-0.158	-0.214	-1.18**	-0.472***	0.125***	0.144***
	(0.689)	(0.370)	(0.470)	(0.153)	(0.048)	(0.052)
Intercept	9.49	4.34	-0.93	1.17	0.23	-0.06
Std. dev.	5.77	2.92	3.78	1.26	0.43	0.45
N	1,396	1,396	1,396	1,396	1,396	1,396
Female students						
STEM	0.158	-0.086	-0.663***	-0.103	0.025	0.009
	(0.426)	(0.226)	(0.254)	(0.126)	(0.033)	(0.035)
Intercept	7.31	3.54	1.67	1.59	-0.26	-0.10
Std. dev.	5.03	2.63	3.15	1.37	0.42	0.43
N	2,510	2,510	2,510	2,510	2,510	2,510

- STEM doesn't affect the # of friends, but leads to fewer female v. male friends ...
- makes boys read for 0.5 hours less on a typical weekday ...
- ↑'s the extent to which boys hold traditionalist expectations and right-wing political views

Other results

- STEM assignment makes students score lower on a Romanian language exam and report being worse at perceiving emotions
- STEM assignment doesn't affect trust, which types of books students like, or whether a student voted in a national election
- A year after high school, STEM assignment makes girls (but not boys) more likely to think that climate change is important and that boys and girls are equally good in math

Conclusion

- In the paper, try to disentangle whether effects are due to curriculum or peer composition
  - → The evidence favors curriculum
  - E.g., there is no effect of scoring above a within-curriculum cutoff;
    also, effects remain after using cutoff-level variation to "adjust" for peers
- Overall, the paper suggests that what students study in high school can have large effects

  (Students' minds are still malleable in high school)
- In addition, STEM and HSS each have advantages

Appendix

Related literature

- A large literature shows that K-12 curriculum affects college-going, careers, and earnings

  Altonji 1995; Rose and Betts 2004; Joensen and Nielsen 2009, 2014; Cortes, Goodman, and Nomi 2015; Darolia et al. 2020; De Phillipis 2021; Cohodes, Ho, and Robles 2022; Dahl, Rooth, and Stenberg 2023; Liu, Conrad, and Blazar 2024

  → We contribute by tackling some remaining open questions

- Existing work (e.g., Zafar 2013; Patnaik et al. 2020) highlights the role of beliefs and preferences in college and career decisions, treating them as given

  → We show that beliefs/preferences can be endogenous to h.s. curricular exposure

- Research establishes brain malleability in early childhood (e.g., Heckman 2006)

  → We provide evidence of continued malleability into adolescence

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Related literature, cont.

- Normative arguments (e.g., Nussbaum 2010) posit civic benefits of HSS education
  - → We contribute causal evidence

- Research documents effects of education on social and civic outcomes

  Dee 2004; Milligan et al. 2004; Sondheimer and Green 2010; Oreopoulos and Salvanes 2011; Wantchekon et al. 2015; Rao 2019; Billings, Chyn, and Haggag 2021; Cohodes and Feigenbaum 2023; Firoozi 2023; Paredes et al. 2023; Kaplan, Spenkuch, and Tuttle 2025

  - → We add evidence on the effects of curriculum (e.g., Cantoni et al. 2017), not just the quantity and quality of education or the effects of peer exposure

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Weekly hours of instruction by curricular focus

	STEM	HSS	Dif.
Math and science	14	8	6
Humanities and social studies	12	17	-5
Other	3	4	-1
Total	29	29	0

- STEM has 6 hours more per week in math and science
- And 6 hours less in other subjects

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Illustration of empirical strategy

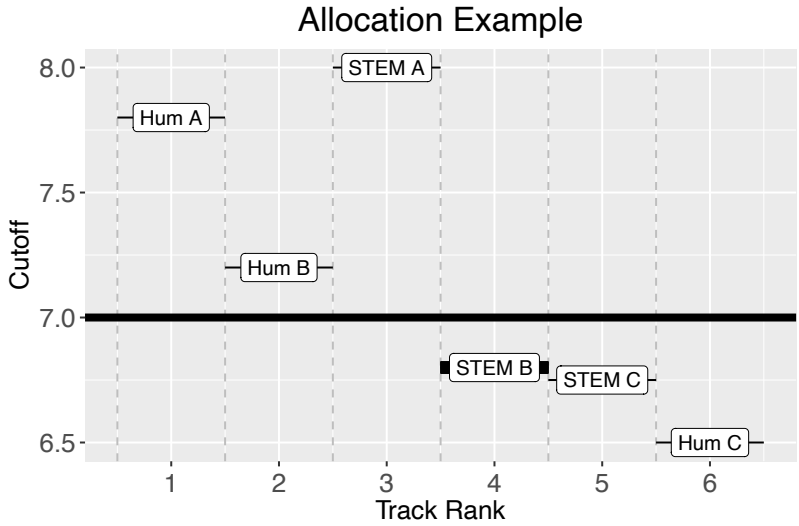

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Illustration of empirical strategy, cont.

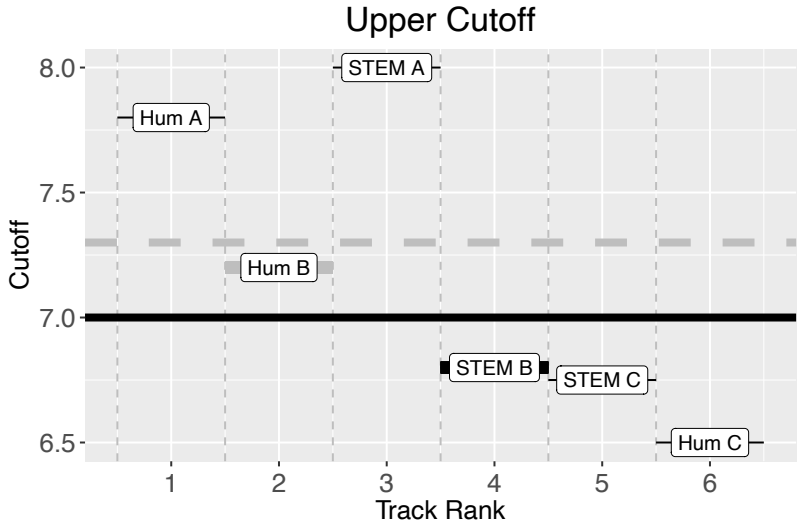

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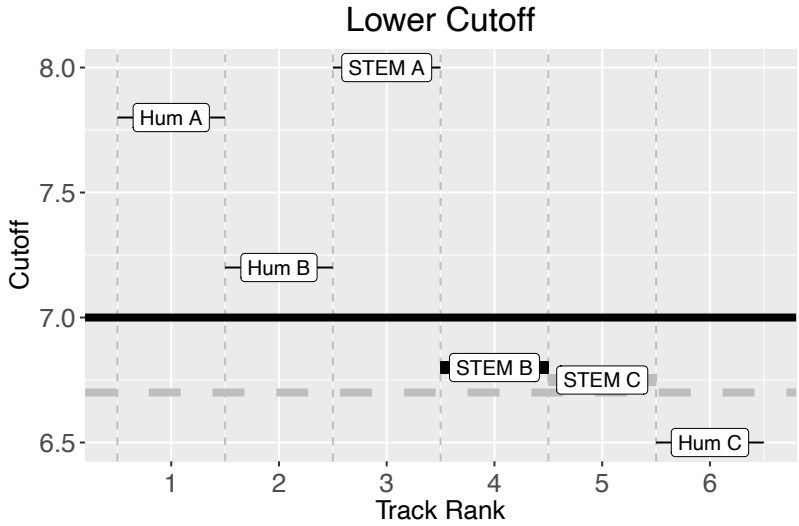
Illustration of empirical strategy, cont.



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Equation

We estimate the following equation:

$$Y_i = \alpha_S \mathbb{1}\{f_j = S\}\mathbb{1}\{r_i > 0\} + \alpha_H \mathbb{1}\{f_j = H\}\mathbb{1}\{r_i > 0\} + \alpha(f_j, c_j, y_i) + h_\alpha(f_j, r_i) + \epsilon_i$$

where:

- student i in cohort y_i has transition score t_i and outcome Y_i
- track j has curriculum focus f_j (H=HSS, S=STEM) and cutoff score c_j
- the running variable r_i is defined to always be positive on the STEM side of the cutoff:
  - $r_i = t_i - c_j$ if STEM-above, $r_i = c_j - t_i$ if STEM-below
- $\alpha(f_j, c_j, y_i)$ are cutoff-specific fixed effects
- $h_\alpha(f_j, r_i)$ are cutoff type-specific linear splines that differ on either side of the cutoff
- α_S (α_H) is the effect of STEM assignment for a STEM-above (-below) cutoff

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Treatments: Effects on attributes of students' tracks

	Average transition score	Average math v. lang. exam score	Share female
Average treatment effects			
STEM	-0.007	0.357***	-0.150***
	(0.007)	(0.010)	(0.004)
Intercept	8.33	-0.89	0.66
Std. dev.	0.92	0.75	0.15
N	73,470	73,470	73,470
Effects for students who prefer STEM			
STEM	0.207***	0.429***	-0.135***
	(0.010)	(0.015)	(0.006)
Intercept	8.54	-0.73	0.66
Std. dev.	0.75	0.66	0.15
N	37,376	37,376	37,376
Effects for students who prefer HSS			
STEM	-0.221***	0.284***	-0.166***
	(0.010)	(0.012)	(0.005)
Intercept	8.13	-1.05	0.66
Std. dev.	0.91	0.73	0.15
N	36,094	36,094	36,094

- The ATE on average transition score is 0. But effects by cutoff type are not

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Effects on high school enrollment and graduation

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
Years of enrollment									
STEM	0.002	0.000	0.003	0.010	-0.017	0.008	0.000	0.007	-0.000
	(0.007)	(0.008)	(0.008)	(0.009)	(0.011)	(0.010)	(0.009)	(0.016)	(0.008)
Intercept	3.91	3.92	3.90	3.91	3.91	3.90	3.91	3.87	3.93
Years of STEM enrollment									
STEM	3.08***	3.01***	3.14***	3.00***	3.22***	2.87***	3.26***	3.25***	3.02***
	(0.023)	(0.030)	(0.027)	(0.028)	(0.031)	(0.033)	(0.025)	(0.038)	(0.028)
Intercept	0.50	0.68	0.32	0.66	0.22	0.68	0.34	0.13	0.66
Graduate									
STEM	-0.003	-0.006*	0.001	-0.001	-0.007	-0.002	-0.001	-0.011	-0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.008)	(0.003)
Intercept	0.96	0.97	0.95	0.97	0.96	0.96	0.96	0.94	0.98
Graduate in STEM									
STEM	0.694***	0.673***	0.714***	0.674***	0.732***	0.630***	0.751***	0.732***	0.683***
	(0.007)	(0.010)	(0.009)	(0.009)	(0.011)	(0.011)	(0.009)	(0.013)	(0.009)
Intercept	0.16	0.22	0.10	0.21	0.07	0.21	0.11	0.04	0.21
N	55,221	28,526	26,695	35,757	19,223	24,127	30,896	18,501	36,720

- First-stage effects are similar across student types

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Effects on college STEM enrollment a year after high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	0.246***	0.259***	0.233***	0.221***	0.287***	0.276***	0.210***	0.219***	0.297***
	(0.036)	(0.052)	(0.040)	(0.065)	(0.046)	(0.060)	(0.044)	(0.052)	(0.050)
Intercept	0.28	0.32	0.25	0.39	0.21	0.30	0.28	0.22	0.34
N	3,327	1,600	1,727	1,591	1,658	1,146	2,098	1,703	1,624

- There is little heterogeneity in the effect of STEM assignment on the probability of being enrolled in a STEM college program a year after high school

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Effects on career plans a year after high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
Technology and engineering									
STEM	0.254***	0.333***	0.175**	0.245***	0.257***	0.360***	0.183***	0.129	0.339***
	(0.051)	(0.072)	(0.067)	(0.084)	(0.063)	(0.119)	(0.051)	(0.105)	(0.066)
Intercept	0.10	0.10	0.10	0.17	0.07	0.21	0.09	0.19	0.06
Medicine									
STEM	-0.041	-0.033	-0.049	-0.051	-0.035	-0.084*	-0.014	-0.050	0.002
	(0.044)	(0.056)	(0.059)	(0.070)	(0.059)	(0.045)	(0.068)	(0.065)	(0.070)
Intercept	0.17	0.17	0.17	0.14	0.16	0.09	0.18	0.11	0.18
Economics and business									
STEM	-0.040	-0.090	0.009	0.030	-0.035	-0.034	-0.033	0.157*	-0.161
	(0.063)	(0.072)	(0.093)	(0.094)	(0.088)	(0.117)	(0.077)	(0.080)	(0.102)
Intercept	0.33	0.35	0.31	0.37	0.25	0.29	0.33	0.12	0.44
Art, education, law, and social services									
STEM	-0.145***	-0.169**	-0.121**	-0.166**	-0.202***	-0.169**	-0.140**	-0.228**	-0.173***
	(0.046)	(0.072)	(0.049)	(0.067)	(0.070)	(0.077)	(0.062)	(0.112)	(0.056)
Intercept	0.23	0.22	0.24	0.18	0.32	0.18	0.26	0.36	0.22
Other/unsure									
STEM	-0.028	-0.041	-0.014	-0.058	0.015	-0.074	0.004	-0.007	-0.008
	(0.040)	(0.056)	(0.050)	(0.065)	(0.051)	(0.101)	(0.047)	(0.090)	(0.044)
Intercept	0.17	0.16	0.18	0.14	0.19	0.23	0.13	0.21	0.10
N	1,159	589	570	546	520	325	746	547	612

- STEM pushes high-achievers into tech, low-achievers into both tech and business

Back

Effects on passing the bacc. exam

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	-0.036***	-0.030***	-0.042***	-0.016***	-0.071***	-0.033***	-0.036***	-0.111***	-0.008**
	(0.004)	(0.004)	(0.007)	(0.004)	(0.007)	(0.006)	(0.005)	(0.010)	(0.003)
Intercept	0.92	0.95	0.89	0.93	0.90	0.91	0.93	0.86	0.97
N	73,470	37,376	36,094	45,077	28,060	31,900	41,295	27,204	46,266

- STEM $\downarrow$'s the probability of passing the bacc. exam by 11 pp for low-achievers
- But < 1 pp for high-achievers

Back

Effects on the bacc. exam score

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	-0.351***	-0.312***	-0.391***	-0.312***	-0.434***	-0.359***	-0.340***	-0.502***	-0.302***
	(0.015)	(0.018)	(0.020)	(0.018)	(0.023)	(0.021)	(0.019)	(0.032)	(0.016)
Intercept	8.08	8.28	7.88	8.17	7.92	7.90	8.24	7.45	8.44
Std. dev.	1.21	1.07	1.30	1.13	1.27	1.22	1.18	1.33	0.96
N	69,938	36,282	33,656	43,454	26,154	30,364	39,321	24,751	45,187

- STEM ↓'s scores on the bacc. exam (conditional on taking it) for everyone
- But effects are particularly large for low-achievers

Back

Effects on being enrolled in college a year after high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	-0.037	-0.065**	-0.009	-0.055	-0.058	0.019	-0.054*	-0.089*	-0.002
	(0.025)	(0.032)	(0.035)	(0.041)	(0.038)	(0.050)	(0.032)	(0.046)	(0.029)
Intercept	0.82	0.90	0.74	0.85	0.79	0.76	0.84	0.77	0.91
N	3,327	1,600	1,727	1,591	1,658	1,146	2,098	1,703	1,624

- STEM ↓'s college enrollment for low-achievers by 9 pp a year after high school

Back

Effects on hours per weekday spent on homework during high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	0.248**	0.331**	0.165	0.308*	0.172	0.342*	0.404***	0.490**	0.058
	(0.109)	(0.157)	(0.123)	(0.175)	(0.150)	(0.185)	(0.124)	(0.192)	(0.153)
Intercept	2.44	2.48	2.41	2.46	2.45	1.86	2.66	2.13	2.75
Std. dev.	1.61	1.67	1.52	1.67	1.53	1.53	1.59	1.50	1.68
N	3,987	1,925	2,062	1,921	1,985	1,396	2,510	2,093	1,894

- STEM $\Rightarrow$ low-achievers spend 0.5 hours more per weekday on homework in high school

Back

Effects on self-reported grit at the end of high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	0.068*	0.051	0.085*	0.068	0.056	0.126**	0.027	0.064	0.047
	(0.036)	(0.043)	(0.048)	(0.062)	(0.052)	(0.060)	(0.051)	(0.051)	(0.053)
Intercept	-0.09	-0.09	-0.09	-0.10	-0.05	-0.14	-0.05	-0.10	-0.04
Std. dev.	0.60	0.60	0.61	0.60	0.60	0.58	0.61	0.61	0.60
N	3,987	1,925	2,062	1,921	1,985	1,396	2,510	2,093	1,894

- STEM induces male students to report higher grit at the end of high school

Back

Effects on students' ratings of the difficulty of the bacc. exam

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	0.173*	0.228**	0.118	0.192*	0.075	0.580***	0.090	0.297**	0.172
	(0.088)	(0.114)	(0.122)	(0.115)	(0.125)	(0.193)	(0.118)	(0.135)	(0.127)
Intercept	1.88	1.85	1.92	1.77	1.95	1.61	1.97	1.74	1.89
Std. dev.	0.73	0.71	0.71	0.74	0.72	0.75	0.72	0.71	0.74
N	1,159	589	570	546	520	325	746	547	612

- By a year after high school, STEM assignment leads students (esp. males and low-achievers) to believe the bacc. exam for their curricular focus is particularly hard

Back

Effects on beliefs about own high school STEM abilities

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
Confidence at the end of high school									
STEM	0.873***	0.789***	0.956***	0.853***	0.916***	0.765***	0.912***	0.876***	0.854***
	(0.077)	(0.106)	(0.092)	(0.123)	(0.105)	(0.127)	(0.093)	(0.125)	(0.110)
Intercept	2.60	2.85	2.36	2.85	2.41	2.75	2.51	2.38	2.87
N	3,987	1,925	2,062	1,921	1,985	1,396	2,510	2,093	1,894

- There is little heterogeneity in the effect of STEM assignment on students' confidence in their abilities in high school STEM subjects

Back

Effects on preferences for high school STEM subjects

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
Preferences one year after high school									
STEM	1.01***	0.850***	1.17***	1.03***	1.14***	1.14***	0.952***	1.07***	1.04***
	(0.151)	(0.184)	(0.208)	(0.275)	(0.192)	(0.290)	(0.191)	(0.287)	(0.208)
Intercept	2.72	3.00	2.43	3.01	2.39	2.78	2.69	2.41	2.83
N	1,159	589	570	546	520	325	746	547	612

- There is little heterogeneity in the effect of STEM assignment on students' preferences for high school STEM subjects

Back

Effects on beliefs about abilities and preferences for college subjects

	STEM subjects	Subjects that involve reading and writing	Subjects that involve memorization
Confidence one year after high school			
STEM	0.659***	-0.396**	-0.278*
	(0.151)	(0.154)	(0.153)
Intercept	2.57	3.23	3.17
Std. dev.	1.39	1.32	1.32
N	1,159	1,159	1,159
Preferences one year after high school			
STEM	0.776***	-0.525***	-0.372**
	(0.149)	(0.164)	(0.157)
Intercept	2.48	3.24	3.06
Std. dev.	1.45	1.31	1.31
N	1,159	1,159	1,159

- STEM ↑'s (↓'s) confidence in and preferences for STEM (HSS) college subjects

Back

Effects on liking O*NET job tasks

	STEM-related tasks					HSS-related tasks			Recommend a STEM job
	Any	Realistic	Investigative	Enterprising	Conventional	Any	Artistic	Social	
STEM	0.064***	0.047	0.082**	0.034	0.086**	-0.062*	-0.064	-0.060	0.104***
	(0.022)	(0.040)	(0.034)	(0.032)	(0.039)	(0.037)	(0.053)	(0.040)	(0.036)
Intercept	0.51	0.31	0.44	0.79	0.51	0.63	0.51	0.75	0.21
N	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199

- STEM ↑'s (↓'s) the chance of liking a STEM- (HSS-) related job task by $\sim$ 6 pp
- And makes O*NET 10 pp more likely to recommend a STEM job

Back

Effects on beliefs about representative jobs

	Would choose	Good pay	Enjoyable work content	Good coworkers & work conditions	Well prepared	Friends & family would approve
An IT, tech, or engineering worker						
STEM	0.146***	0.037	0.614***	0.185	0.543***	0.336**
	(0.047)	(0.077)	(0.185)	(0.157)	(0.199)	(0.135)
Intercept	0.20	4.50	2.58	3.20	2.60	4.05
A humanities teacher						
STEM	-0.054	0.019	-0.153	0.022	-0.371**	0.149
	(0.049)	(0.082)	(0.151)	(0.139)	(0.148)	(0.166)
Intercept	0.18	2.82	2.26	2.86	2.70	3.52
A person who runs a business						
STEM	-0.092	0.066	-0.090	-0.152	-0.336***	-0.086
	(0.061)	(0.113)	(0.142)	(0.124)	(0.115)	(0.108)
Intercept	0.62	4.19	4.20	4.18	3.96	4.49
N	1,199	1,199	1,199	1,199	1,199	1,199

- STEM doesn't affect beliefs about earnings or work conditions
- But influences liking the work content and feeling prepared

Back

Explanations selected for choosing the college field of study

Explanation	Share selecting yes
The subject matched my abilities	0.95
The subject matched my interests	0.94
The subject would lead to a job that I would be happy with	0.91
The subject would lead to a job with high earnings	0.90
My parents wanted me to study the subject	0.79
In high school, I learned about career paths related to the subject	0.56
My high school teachers encouraged me to study the subject	0.48
The subject matched what I studied in high school, and it was hard to change	0.41
I thought the subject would be easy	0.25
The subject is the same as what my friends chose	0.19

- A relatively small share of students select sunk costs or friend/peer influences as reasons why they chose their college field of study
- In contrast, almost everyone cares about what matches their abilities and interests

Back

Explanations expected to drive one's job choice at age 30

Explanation	Share selecting yes
The job has good coworkers and working conditions	0.99
The job provides a high income	0.98
The content of the work involved in the job matches my interests	0.97
The job matches my abilities and educational background	0.96
The job would let me live close to where my friends and family are	0.82
The job is prestigious	0.76
My friends and family would approve of me doing the job	0.73
The job is related to what I studied in high school, and it is hard to change	0.48
The job is easy	0.48
My high school teachers encouraged me to do the job	0.47

- A relatively small share of students select sunk costs or teacher influences as reasons why they expect to choose their job at age 30
- In contrast, almost everyone cares about what matches their abilities and interests

Back

Effects on wellbeing at the end of high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	0.133***	0.111	0.155***	0.192**	0.081	0.055	0.142**	0.094	0.114
	(0.051)	(0.077)	(0.053)	(0.077)	(0.077)	(0.088)	(0.068)	(0.085)	(0.077)
Intercept	-0.14	-0.14	-0.13	-0.15	-0.09	-0.00	-0.20	-0.06	-0.16
Std. dev.	0.74	0.75	0.72	0.75	0.72	0.72	0.73	0.71	0.76
N	3,987	1,925	2,062	1,921	1,985	1,396	2,510	2,093	1,894

- STEM appears to ↑ wellbeing at the end of high school for all student types

Back

Effects on hours per weekday spent on social media during high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	-0.428***	-0.462***	-0.394***	-0.453***	-0.325*	-0.215	-0.437***	-0.064	-0.560***
	(0.111)	(0.146)	(0.138)	(0.163)	(0.175)	(0.189)	(0.147)	(0.185)	(0.148)
Intercept	3.42	3.32	3.53	3.26	3.50	2.87	3.68	3.19	3.48
Std. dev.	1.69	1.67	1.70	1.67	1.68	1.69	1.64	1.70	1.68
N	3,987	1,925	2,062	1,921	1,985	1,396	2,510	2,093	1,894

- STEM $\Rightarrow$ students spend 0.4 hours less per weekday on social media in high school

Back

Effects on wellbeing and high school satisfaction a year after high school

	Well-being	**Liked the high school:** Experience	Curriculum	Peers	Teachers	**H.s. curric. was good fit**
STEM	-0.033	0.217*	-0.004	0.287**	0.128	-0.123
	(0.068)	(0.110)	(0.137)	(0.138)	(0.130)	(0.118)
Intercept	0.66	3.90	3.13	3.82	3.75	3.49
Std. dev.	0.56	0.89	1.06	1.08	0.93	1.02
N	1,199	1,159	1,159	1,159	1,159	1,159

- By a year after high school, STEM assignment doesn't affect wellbeing and has mixed impacts on high school satisfaction

Back

Effects on happiness with h.s. application choices a year after high school

	All	Prefer		Stronger in		Gender		Cutoff score	
		STEM	HSS	Math	Language	Male	Female	Low	High
STEM	0.049	0.282	-0.185	0.215	-0.172	-0.049	0.112	-0.452**	0.265
	(0.129)	(0.189)	(0.155)	(0.219)	(0.191)	(0.189)	(0.156)	(0.183)	(0.172)
Intercept	4.20	4.14	4.25	3.99	4.31	4.27	4.16	4.48	4.06
Std. dev.	0.94	0.92	0.94	0.97	0.91	0.85	0.98	0.92	0.95
N	1,159	589	570	546	520	325	746	547	612

- By a year after high school, STEM assignment makes low-achievers less happy with their high school application choices
- This is consistent with the fact that STEM is risky and difficult for low-achievers

Back

Effects on college satisfaction a year after high school

	Like the college:				College curric.	Happy w/ col.
	Experience	Curriculum	Peers	Instructors	is good fit	applic. choices
STEM	-0.443***	-0.227*	-0.398**	-0.352***	0.082	0.122
	(0.138)	(0.129)	(0.166)	(0.134)	(0.156)	(0.179)
Intercept	2.20	2.25	2.18	2.31	3.48	3.72
Std. dev.	1.11	1.09	1.20	1.14	1.33	1.48
N	1,159	1,159	1,159	1,159	1,159	1,159

- By a year after high school, STEM makes students like college less
- However, it doesn't affect how happy students are with their college application choices

Back

Effects on expectations at the end of high school

	Work amount	Bread-winner	Wealth decile	Number of children	Smaller locale	Traditionalist expectations
Male students						
STEM	0.035	0.150**	0.062	0.173*	0.076	0.125***
	(0.064)	(0.064)	(0.159)	(0.101)	(0.116)	(0.048)
Intercept	2.72	2.34	7.56	1.65	2.19	0.23
Std. dev.	0.59	0.55	1.46	0.88	0.94	0.43
N	1,396	1,396	1,396	1,396	1,396	1,396
Female students						
STEM	-0.026	0.014	0.159	0.006	0.010	0.025
	(0.036)	(0.035)	(0.118)	(0.076)	(0.070)	(0.033)
Intercept	2.83	2.04	7.43	1.68	2.16	-0.26
Std. dev.	0.41	0.41	1.43	0.94	0.89	0.42
N	2,510	2,510	2,510	2,510	2,510	2,510

- STEM ↑'s the extent to which boys hold traditionalist expectations

Back

Effects on political views at the end of high school

	The poor are lazy	Redistribution is bad	High-achievers should choose first	Tradition is good	Wife earning more is a problem	Divorce is immoral	Right-wing political views
Male students							
STEM	0.298**	0.077	0.118***	0.062	0.114	0.062	0.144***
	(0.138)	(0.161)	(0.038)	(0.130)	(0.140)	(0.119)	(0.052)
Intercept	2.55	3.05	0.48	3.75	1.86	1.97	-0.06
Std. dev.	1.20	1.27	0.33	1.16	1.24	1.21	0.45
N	1,396	1,396	1,396	1,396	1,396	1,396	1,396
Female students							
STEM	-0.096	-0.062	-0.012	0.060	0.014	0.196**	0.009
	(0.108)	(0.108)	(0.029)	(0.089)	(0.097)	(0.098)	(0.035)
Intercept	2.34	3.15	0.57	3.75	1.80	1.53	-0.10
Std. dev.	1.16	1.25	0.34	1.10	1.18	1.09	0.43
N	2,510	2,510	2,510	2,510	2,510	2,510	2,510

- STEM ↑'s the extent to which boys hold right-wing political views

Back

Effects on additional civic and social outcomes

	Romanian lang. exam score			Can tell when someone is sad		
	All	Male	Female	All	Male	Female
STEM	-0.076***	-0.066***	-0.072***	-0.094*	-0.131	-0.062
	(0.016)	(0.025)	(0.021)	(0.055)	(0.102)	(0.071)
Intercept	7.78	7.46	8.07	4.40	4.32	4.44
Std. dev.	1.34	1.36	1.26	0.89	0.92	0.86
N	70,272	30,516	39,496	3,987	1,396	2,510

- STEM assignment makes students score lower on a Romanian language exam (conditional on taking it) and report being worse at perceiving when others are sad

Back

Effects on additional civic and social outcomes

	Can trust most people	Can trust government workers	In books, prefer characters to plots	Voted in the 2024 election
STEM	0.009	0.044	0.104	0.027
	(0.066)	(0.068)	(0.076)	(0.036)
Intercept	2.10	2.09	2.73	0.87
Std. dev.	1.07	1.02	1.28	0.26
N	3,987	3,987	3,987	1,199

- STEM assignment doesn't affect trust, which types of books students like, or whether a student voted in a national election

Back

Effects on political views a year after high school

	Male students		Female students	
	Climate change is one of the most serious issues	Boys are naturally better in math	Climate change is one of the most serious issues	Boys are naturally better in math
STEM	-0.010	0.034	0.359**	-0.415**
	(0.295)	(0.287)	(0.179)	(0.205)
Intercept	3.39	2.76	3.15	2.83
Std. dev.	1.27	1.18	1.16	1.23
N	372	373	721	728

- A year after high school, STEM assignment makes girls (but not boys) more likely to think that climate change is important and that boys and girls are equally good in math

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