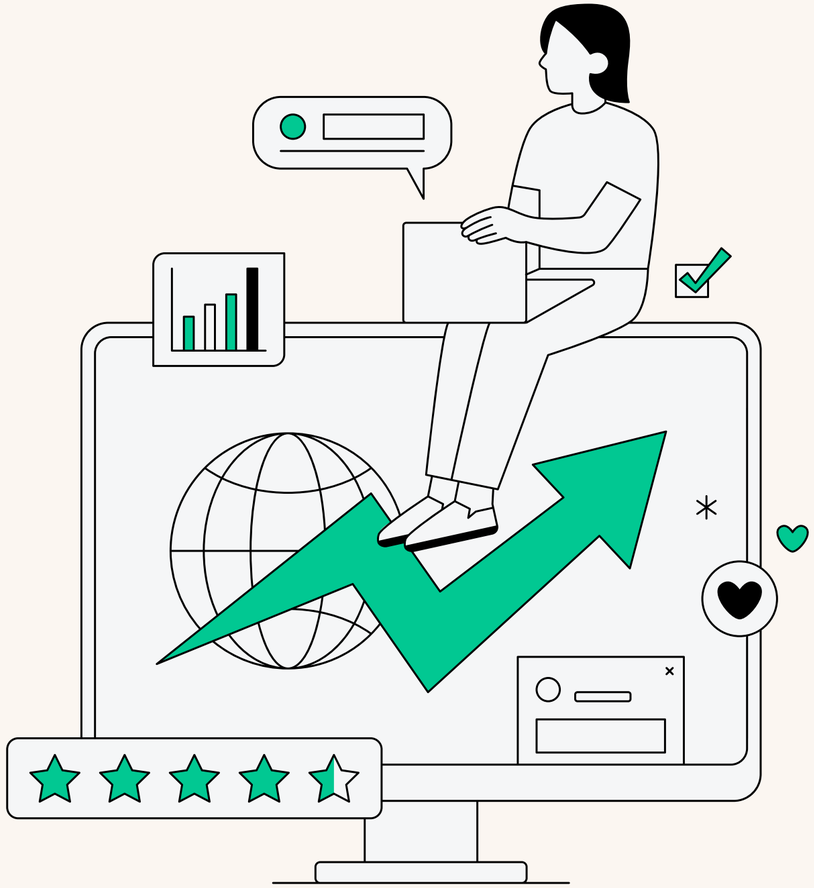
Presented by Henrietta Kadi

A Regression-Based Investigation of Student- and Teacher-Level Influences on Math Performance on TIMSS 2023



TIMSS 2023 Data

- TIMSS stands for Trends in International Mathematics and Science Study
- Conducted every four years at the 4^{th} and 8^{th} grade levels
- An international measure of math and science achievement of 4^{th} and 8^{th} grade students
- Also collects information on school resources, teacher training/characteristics, home background and curriculum implementation
- 64 countries participated in the 2023 cycle
- 2 countries – U.S.A. and Canada are used in this analysis.

Research Goals and Questions

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Explore factors influencing an individual student's math score using:

- Student-level factors
- Home-level factors
- Teacher-level factors.

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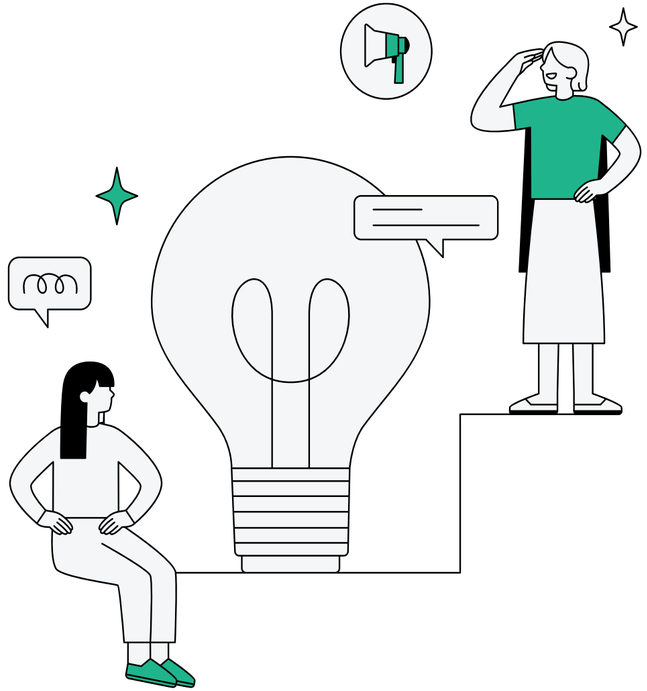

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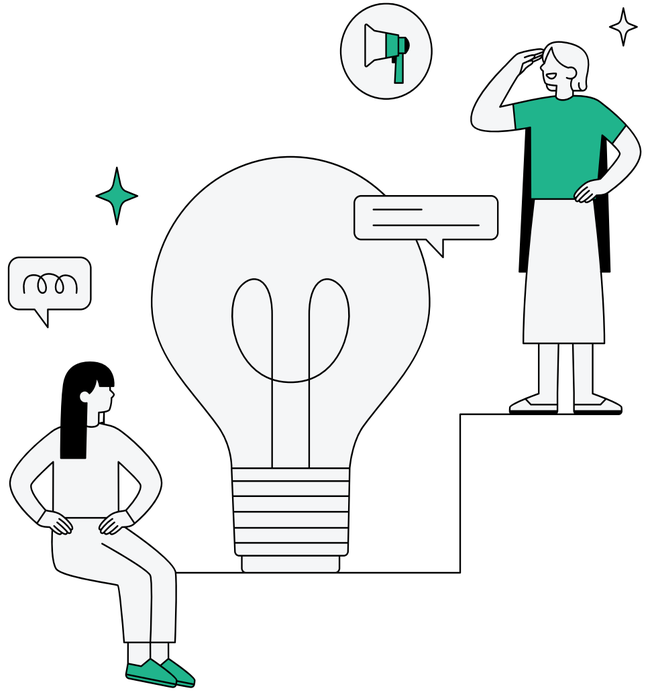

Research Questions

- What proportion of variation in the performance of a student on the math test is explained by factors such as gender, country, student confidence among others?
    - Are there are any country-level and/or sex differences in math scores?
- How do various teacher characteristics influence student's score on the math test?
    - Are they differences in students' math percentage scores across levels of age or formal education completed by the teacher?

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- Difference-in-Difference Analysis: Significant difference between the effects in various subgroup analyses including combinations of sex and country.
    - For example, are gender differences in the U.S.A. significantly different from Canada?
- Marginal Contrast Analysis: A post-hoc analysis to compare the difference between estimated (marginal means) of the response variable across levels a specific predictor given average values of all ither predictors.
    - For example, are there differences in the math score of students who had teachers under 25 vs those with teachers between 25 – 29?

Student-Level Analysis

Sample Information

- . Country: Country of Participation (CAN = 1, USA = 2)
- Sex: Sex/Gender (1 = Girl, 2 = Boy)Age : Age of student
- Number_of_Home_Study_Supports: Derived from subscale measuring resources available to the student at home.
- Disorderly_Behavior: Scale score from the subscale measuring disorderly behavior during math lessons.
- Instructional_Clarity: Scale score from the subscale measuring instructional clarity in mathematics lessons.
- Digital_Self_Efficacy: Scale score from the subscale measuring digital self-efficacy.
- Sense_of_School_Belonging: Scale score from the subscale measuring students sense of school belonging.
- Student_Bullying: Scale score from the subscale measuring student bullying.
- Like_Learning_Math: Scale score from the subscale measuring if students like learning mathematics.
- Confident_in_Math: Scale score from the subscale measuring students' confidence in mathematics.
- Math_Percent_Correct: Students' percent correct on the 2023 TIMSS Math Achievement Test.

Descriptive Statistics

	CAN (N=10616)	USA (N=7753)	Overall (N=18369)
Mathematics Percent Correct Points Scored			
Mean (SD)	49.8 (22.9)	55.0 (24.9)	52.0 (23.9)
Median [Min, Max]	50.0 [0, 100]	56.5 [0, 100]	52.0 [0, 100]
Disorderly Behavior during Math Lessons/SCL			
Mean (SD)	9.63 (1.60)	9.54 (1.74)	9.59 (1.66)
Median [Min, Max]	9.67 [6.16, 14.8]	9.67 [6.16, 14.8]	9.67 [6.16, 14.8]
Student Bullying/SCL			
Mean (SD)	9.76 (1.72)	9.90 (1.88)	9.82 (1.79)
Median [Min, Max]	9.50 [3.81, 12.8]	9.71 [3.81, 12.8]	9.71 [3.81, 12.8]
Instructional Clarity in Mathematics Lessons/SCL			
Mean (SD)	10.1 (1.86)	9.95 (1.97)	10.0 (1.91)
Median [Min, Max]	10.6 [2.46, 12.1]	9.79 [2.46, 12.1]	9.79 [2.46, 12.1]
Digital Self-Efficacy/SCL			
Mean (SD)	10.4 (1.91)	10.1 (1.88)	10.2 (1.91)
Median [Min, Max]	10.1 [3.27, 14.0]	9.68 [3.27, 14.0]	10.1 [3.27, 14.0]
Students Sense of School Belonging/SCL			
Mean (SD)	9.93 (1.96)	9.65 (1.91)	9.81 (1.95)
Median [Min, Max]	9.68 [3.61, 12.9]	9.68 [3.61, 12.9]	9.68 [3.61, 12.9]
Students Like Learning Mathematics/SCL			
Mean (SD)	9.90 (1.95)	9.86 (2.06)	9.88 (2.00)
Median [Min, Max]	9.76 [4.93, 12.6]	9.76 [4.93, 12.6]	9.76 [4.93, 12.6]

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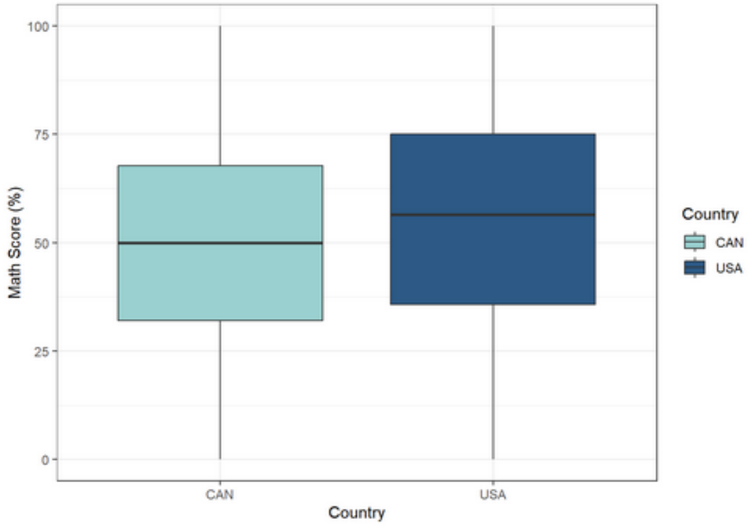
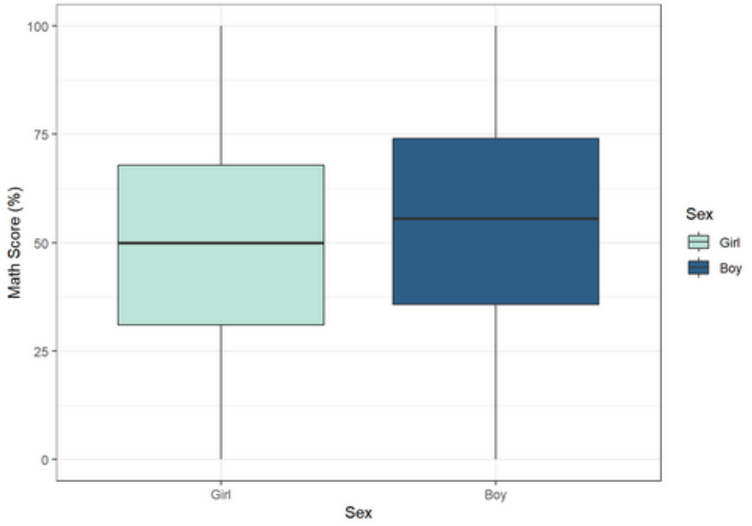
	CAN (N=10616)	USA (N=7753)	Overall (N=18369)
Students Age			
Mean (SD)	9.91 (0.342)	10.2 (0.383)	10.0 (0.390)
Median [Min, Max]	9.92 [6.42, 11.8]	10.2 [8.58, 12.4]	10.0 [6.42, 12.4]
Sex			
Girl	5491 (51.7%)	3860 (49.8%)	9351 (50.9%)
Boy	5125 (48.3%)	3893 (50.2%)	9018 (49.1%)
Country			
CAN	10616 (100%)	0 (0%)	10616 (57.8%)
USA	0 (0%)	7753 (100%)	7753 (42.2%)
Students Confident in Mathematics/SCL			
Mean (SD)	10.2 (2.00)	10.1 (2.12)	10.1 (2.05)
Median [Min, Max]	9.81 [3.70, 14.2]	9.80 [3.70, 14.2]	9.81 [3.70, 14.2]
Number_of_Home_Study_Supports			
Neither Own Room nor Access to the Internet	284 (2.7%)	232 (3.0%)	516 (2.8%)
Either Own Room or Access to the Internet	2617 (24.7%)	2287 (29.5%)	4904 (26.7%)
Both Own Room and Access to the Internet	7715 (72.7%)	5234 (67.5%)	12949 (70.5%)

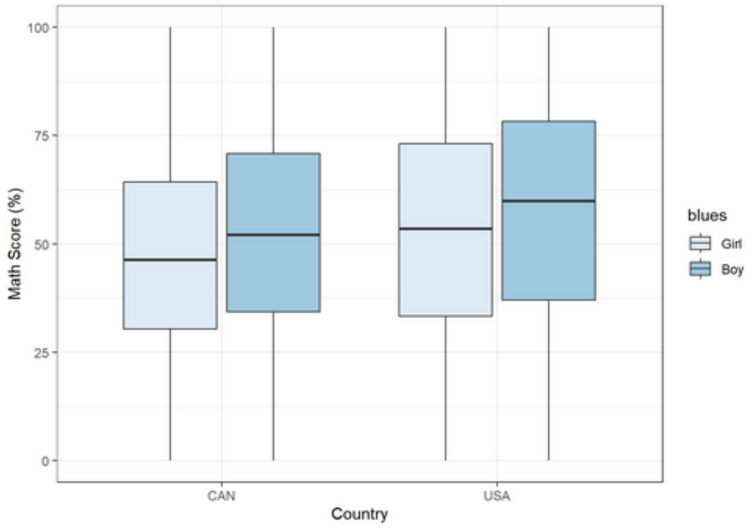
Descriptive Statistics



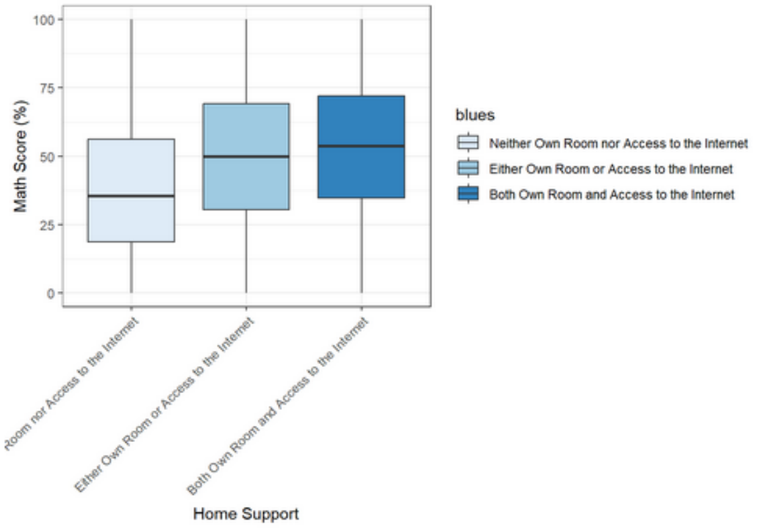
(a) Boxplots of the Distribution of Scores by Country



(b) Boxplots of the Distribution of Scores by Sex



(c) Boxplots of the Distribution of Scores by Country and Sex



(d) Boxplots of the Distribution of Scores by Home Support

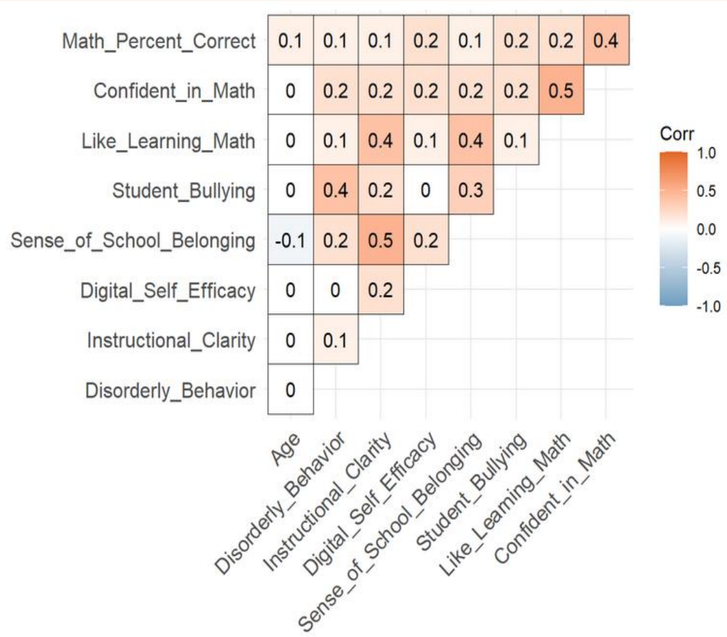


Figure 4: Correlation Heatmap for Student-Level Analysis

Step-wise Regression Analysis

(a) Student Level Regression Coefficients

term	estimate	std.error	statistic	p.value
(Intercept)	-35.487	4.634	-7.658	0.000
CountryUSA	5.584	0.346	16.123	0.000
SexBoy	2.006	0.320	6.279	0.000
Age	1.112	0.437	2.546	0.011
Disorderly_Behavior	0.603	0.102	5.903	0.000
Instructional_Clarity	-0.164	0.092	-1.779	0.075
Digital_Self_Efficacy	1.054	0.087	12.060	0.000
Student_Bullying	1.021	0.097	10.582	0.000
Like_Learning_Math	-0.968	0.098	-9.892	0.000
Confident_in_Math	4.773	0.094	50.695	0.000
Number_of_Home_Study_SupportsEither Own Room or Access to the Internet	8.055	0.990	8.140	0.000
Number_of_Home_Study_SupportsBoth Own Room and Access to the Internet	10.088	0.965	10.451	0.000

(b) Student Level Model Summary Statistics

r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.residual	nobs
0.208	0.208	21.298	439.394	0	11	-82242.15	164510.3	164611.9	8326823	18357	18369

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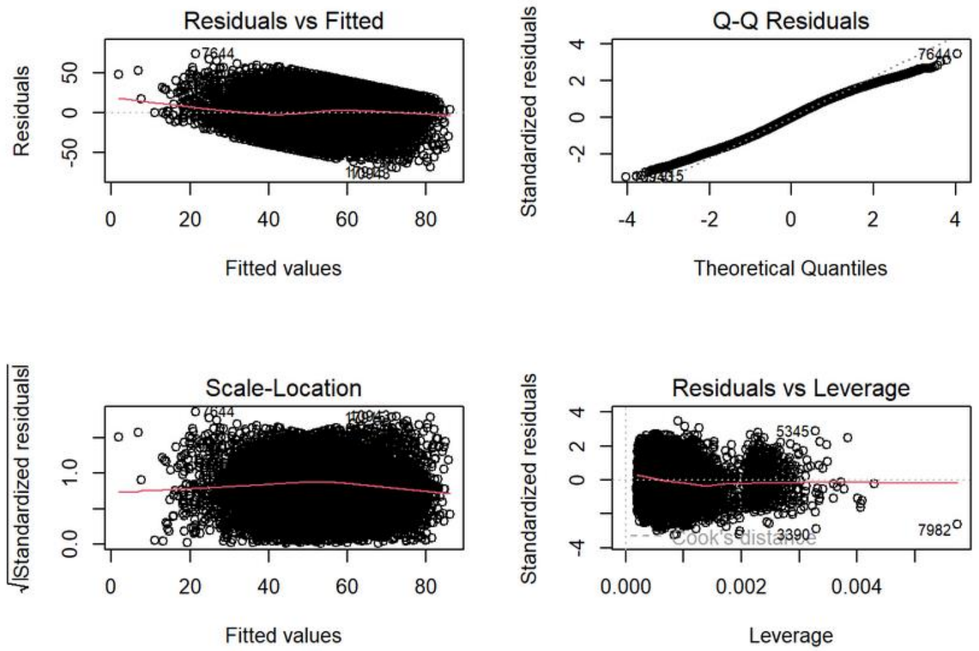
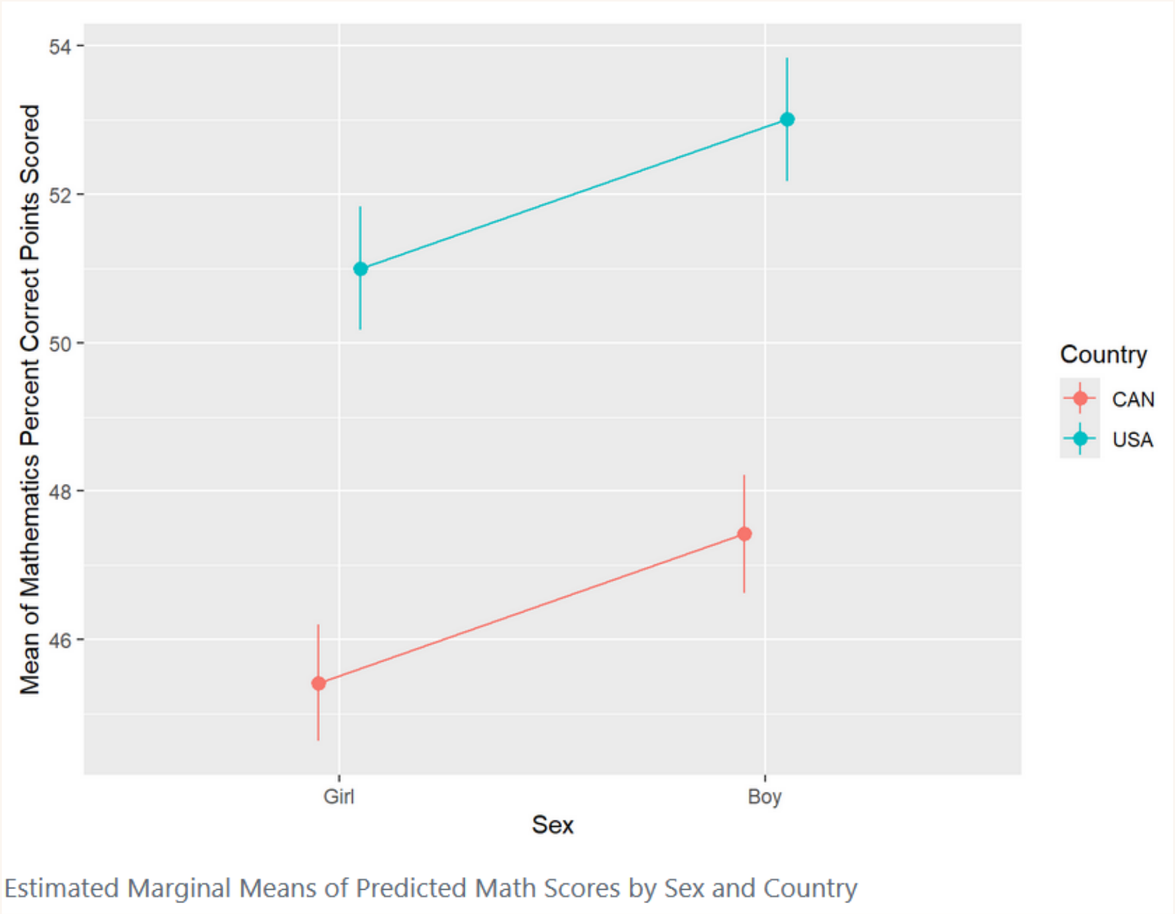


Figure 5: Residual Plots for the Student Level Regression Model

Key-Takeaway

- Despite most of the predictors being significant, they explain a relatively small proportion of variation in math scores suggesting that many additional factors (curriculum, school resources) are likely to contribute to students' performances.

Differences-in-Difference Analysis



Estimated Marginal Means of Predicted Math Scores by Sex and Country

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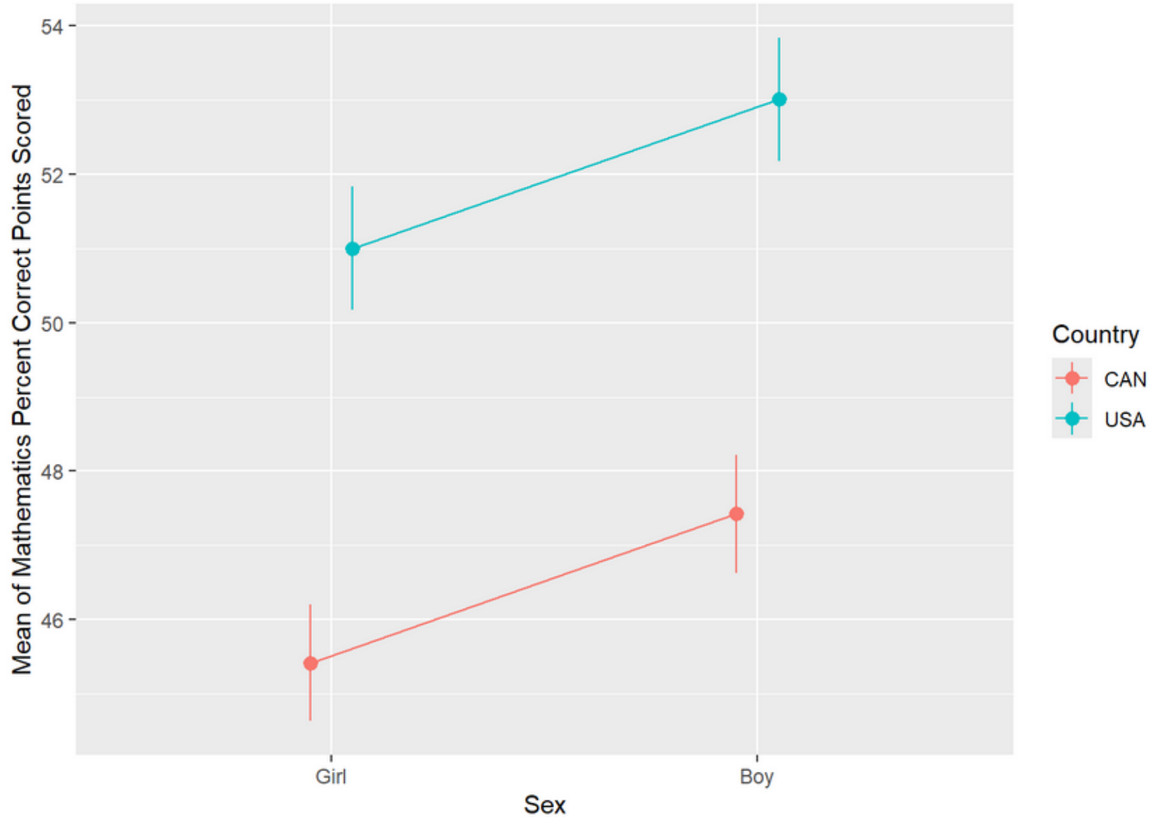

Estimated Marginal Means of Predicted Math Scores by Sex and Country

(a) Estimated Marginal Means of Predicted Math Scores by Sex and Country

Sex	Country	Mean	SE	CI_low	CI_high	t	df
Girl	CAN	45.416	0.400	44.632	46.199	113.611	18357
Girl	USA	51.000	0.422	50.172	51.828	120.766	18357
Boy	CAN	47.422	0.404	46.630	48.214	117.353	18357
Boy	USA	53.006	0.422	52.179	53.833	125.643	18357

(b) Pairwise Contrasts of Predicted Math Scores by Sex and Country

Level1	Level2	Difference	SE	CI_low	CI_high	t	df	p
Girl, USA	Girl, CAN	5.584	0.346	4.905	6.263	16.123	18357	0
Boy, CAN	Girl, CAN	2.006	0.320	1.380	2.633	6.279	18357	0
Boy, USA	Girl, CAN	7.590	0.467	6.675	8.506	16.249	18357	0
Boy, CAN	Girl, USA	-3.577	0.475	-4.509	-2.646	-7.527	18357	0
Boy, USA	Girl, USA	2.006	0.320	1.380	2.633	6.279	18357	0
Boy, USA	Boy, CAN	5.584	0.346	4.905	6.263	16.123	18357	0

Key-Takeaway

- While gender differences exist, the national level factors may play a more substantial role in the TIMSS math score of 4th grade students.
- Further research should explore some potential national level contributors like curriculum standards.

Teacher-Level Analysis

Sample Information

- Years_Teaching: Years teacher has been teaching
- Sex: Sex/Gender of teacher (1: Female; 2: Male; 3: Other)
- Age: Age of Teacher (1: Under 25; 2: 25–29; 3: 30–39; 4: 40–49; 5: 50–59; 6: 60 or more)
- Formal_Educ: Level of formal education teacher has completed (1: Did not complete Upper secondary education—ISCED Level 3; 2: Upper secondary education—ISCED Level 3 (have not completed postsecondary or tertiary education); 3: Post-secondary, non-tertiary education—ISCED Level 4; 4: Short-cycle tertiary education—ISCED Level 5; 5: Bachelor's or equivalent level—ISCED Level 6; 6: Master's or equivalent level—ISCED Level 7; 7: Doctor or equivalent level—ISCED Level 8)
- Class_Size: Number of students in the class.
- Homework_Freq: How often math homework is assigned (1: I do not assign mathematics homework; 2: Less than once a week; 3: 1 or 2 times a week; 4: 3 or 4 times a week; 5: Every day)
- Academic_Success: Scale score from the subscale measuring school emphasis on academic success-teacher.
- Safe_Orderly_Schools : Scale score from the subscale measuring safe and orderly schools-teacher.
- Job_Satis : Scale score from the subscale measuring teachers job satisfaction.
- Student_not_Ready: Scale score from the subscale measuring teaching limited by student not ready.
- Math_Major : Teachers majored in education and mathematics (1: Major in Edu and Math; 2: Major in Edu but not Math; 3: Major in Math but not Edu; 4: All other Majors; 5: No Formal Edu Beyond Upper Secondary).
- Instruction_Hours: Mathematics instruction hours per week
- Math_Percent_Correct: Students' percent correct on the 2023 TIMSS Math Achievement Test.

Descriptive Statistics

	Female (N=15612)	Male (N=2430)	Other (N=152)	Overall (N=18194)
Mathematics Percent Correct Points Scored				
Mean (SD)	50.4 (24.1)	50.4 (24.4)	45.5 (23.7)	50.4 (24.1)
Median [Min, Max]	50.0 [0, 100]	50.0 [0, 100]	42.3 [5.26, 96.3]	50.0 [0, 100]
Years of Teaching				
Mean (SD)	14.1 (8.70)	15.9 (8.78)	17.2 (10.0)	14.4 (8.75)
Median [Min, Max]	14.0 [1.00, 43.0]	16.0 [1.00, 37.0]	17.0 [1.00, 40.0]	14.0 [1.00, 43.0]
Number of Students in Class				
Mean (SD)	23.6 (5.88)	24.3 (5.35)	22.8 (4.13)	23.7 (5.80)
Median [Min, Max]	24.0 [1.00, 117]	25.0 [4.00, 46.0]	25.0 [14.0, 27.0]	24.0 [1.00, 117]
School Emphasis on Teacher's Academic Success				
Mean (SD)	9.90 (2.17)	10.2 (2.65)	9.17 (3.33)	9.93 (2.26)
Median [Min, Max]	9.72 [4.33, 17.0]	10.1 [0.698, 17.0]	8.27 [5.70, 17.0]	9.72 [0.698, 17.0]
Safe and Orderly Schools-Teacher				
Mean (SD)	9.45 (2.23)	9.68 (2.30)	7.89 (2.35)	9.46 (2.24)
Median [Min, Max]	9.32 [4.16, 13.1]	9.32 [4.16, 13.1]	7.86 [4.16, 13.1]	9.32 [4.16, 13.1]
Teachers Job Satisfaction				
Mean (SD)	9.41 (2.14)	9.68 (2.14)	9.80 (2.25)	9.45 (2.14)
Median [Min, Max]	9.59 [4.59, 12.3]	9.59 [4.59, 12.3]	9.05 [6.29, 12.3]	9.59 [4.59, 12.3]
Teaching Limited by Student Not Ready				
Mean (SD)	9.00 (1.66)	9.24 (1.68)	8.70 (1.10)	9.03 (1.66)
Median [Min, Max]	8.86 [3.23, 15.2]	8.86 [4.75, 15.2]	9.33 [6.65, 13.6]	8.86 [3.23, 15.2]

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Mathematics Percent Correct Points Scored				
Mean (SD)	50.4 (24.1)	50.4 (24.4)	45.5 (23.7)	50.4 (24.1)
Median [Min, Max]	50.0 [0, 100]	50.0 [0, 100]	42.3 [5.26, 96.3]	50.0 [0, 100]
Years of Teaching				
Mean (SD)	14.1 (8.70)	15.9 (8.78)	17.2 (10.0)	14.4 (8.75)
Median [Min, Max]	14.0 [1.00, 43.0]	16.0 [1.00, 37.0]	17.0 [1.00, 40.0]	14.0 [1.00, 43.0]
Number of Students in Class				
Mean (SD)	23.6 (5.88)	24.3 (5.35)	22.8 (4.13)	23.7 (5.80)
Median [Min, Max]	24.0 [1.00, 117]	25.0 [4.00, 46.0]	25.0 [14.0, 27.0]	24.0 [1.00, 117]
School Emphasis on Teacher's Academic Success				
Mean (SD)	9.90 (2.17)	10.2 (2.65)	9.17 (3.33)	9.93 (2.26)
Median [Min, Max]	9.72 [4.33, 17.0]	10.1 [0.698, 17.0]	8.27 [5.70, 17.0]	9.72 [0.698, 17.0]
Safe and Orderly Schools-Teacher				
Mean (SD)	9.45 (2.23)	9.68 (2.30)	7.89 (2.35)	9.46 (2.24)
Median [Min, Max]	9.32 [4.16, 13.1]	9.32 [4.16, 13.1]	7.86 [4.16, 13.1]	9.32 [4.16, 13.1]
Teachers Job Satisfaction				
Mean (SD)	9.41 (2.14)	9.68 (2.14)	9.80 (2.25)	9.45 (2.14)
Median [Min, Max]	9.59 [4.59, 12.3]	9.59 [4.59, 12.3]	9.05 [6.29, 12.3]	9.59 [4.59, 12.3]
Teaching Limited by Student Not Ready				
Mean (SD)	9.00 (1.66)	9.24 (1.68)	8.70 (1.10)	9.03 (1.66)
Median [Min, Max]	8.86 [3.23, 15.2]	8.86 [4.75, 15.2]	9.33 [6.65, 13.6]	8.86 [3.23, 15.2]
Age of Teacher				
Under 25	660 (4.2%)	23 (0.9%)	0 (0%)	683 (3.8%)
25–29	2020 (12.9%)	200 (8.2%)	13 (8.6%)	2233 (12.3%)
30–39	4154 (26.6%)	557 (22.9%)	45 (29.6%)	4756 (26.1%)
40–49	5100 (32.7%)	795 (32.7%)	45 (29.6%)	5940 (32.6%)
50–59	3357 (21.5%)	711 (29.3%)	21 (13.8%)	4089 (22.5%)
60 or more	321 (2.1%)	144 (5.9%)	28 (18.4%)	493 (2.7%)
Level of Formal Education Completed				
Post-secondary, non-tertiary education	9 (0.1%)	0 (0%)	0 (0%)	9 (0.0%)
Short-cycle tertiary education	6 (0.0%)	0 (0%)	0 (0%)	6 (0.0%)
Bachelor's or equivalent	10894 (69.8%)	1525 (62.8%)	151 (99.3%)	12570 (69.1%)
Master's or equivalent	4661 (29.9%)	866 (35.6%)	1 (0.7%)	5528 (30.4%)
Doctor or equivalent	42 (0.3%)	39 (1.6%)	0 (0%)	81 (0.4%)
Homework Frequency				
I do not assign mathematics homework	5146 (33.0%)	767 (31.6%)	56 (36.8%)	5969 (32.8%)
Less than once a week	3166 (20.3%)	400 (16.5%)	47 (30.9%)	3613 (19.9%)
1 or 2 times a week	3931 (25.2%)	440 (18.1%)	13 (8.6%)	4384 (24.1%)
3 or 4 times a week	2193 (14.0%)	500 (20.6%)	20 (13.2%)	2713 (14.9%)
Every day	1176 (7.5%)	323 (13.3%)	16 (10.5%)	1515 (8.3%)
Teachers Majored in Education and Mathematics				
Major in Edu and Math	1856 (11.9%)	438 (18.0%)	47 (30.9%)	2341 (12.9%)
Major in Edu but not Math	11429 (73.2%)	1440 (59.3%)	64 (42.1%)	12933 (71.1%)
Major in Math but not Edu	264 (1.7%)	86 (3.5%)	0 (0%)	350 (1.9%)
All other Majors	2063 (13.2%)	466 (19.2%)	41 (27.0%)	2570 (14.1%)

Descriptive Statistics

	Female (N=15612)	Male (N=2430)	Other (N=152)	Overall (N=18194)
Mathematics Percent Correct Points Scored				
Mean (SD)	50.4 (24.1)	50.4 (24.4)	45.5 (23.7)	50.4 (24.1)
Median [Min, Max]	50.0 [0, 100]	50.0 [0, 100]	42.3 [5.26, 96.3]	50.0 [0, 100]
Years of Teaching				
Mean (SD)	14.1 (8.70)	15.9 (8.78)	17.2 (10.0)	14.4 (8.75)
Median [Min, Max]	14.0 [1.00, 43.0]	16.0 [1.00, 37.0]	17.0 [1.00, 40.0]	14.0 [1.00, 43.0]
Number of Students in Class				
Mean (SD)	23.6 (5.88)	24.3 (5.35)	22.8 (4.13)	23.7 (5.80)
Median [Min, Max]	24.0 [1.00, 117]	25.0 [4.00, 46.0]	25.0 [14.0, 27.0]	24.0 [1.00, 117]
School Emphasis on Teacher's Academic Success				
Mean (SD)	9.90 (2.17)	10.2 (2.65)	9.17 (3.33)	9.93 (2.26)
Median [Min, Max]	9.72 [4.33, 17.0]	10.1 [0.698, 17.0]	8.27 [5.70, 17.0]	9.72 [0.698, 17.0]
Safe and Orderly Schools-Teacher				
Mean (SD)	9.45 (2.23)	9.68 (2.30)	7.89 (2.35)	9.46 (2.24)
Median [Min, Max]	9.32 [4.16, 13.1]	9.32 [4.16, 13.1]	7.86 [4.16, 13.1]	9.32 [4.16, 13.1]
Teachers Job Satisfaction				
Mean (SD)	9.41 (2.14)	9.68 (2.14)	9.80 (2.25)	9.45 (2.14)
Median [Min, Max]	9.59 [4.59, 12.3]	9.59 [4.59, 12.3]	9.05 [6.29, 12.3]	9.59 [4.59, 12.3]
Teaching Limited by Student Not Ready				
Mean (SD)	9.00 (1.66)	9.24 (1.68)	8.70 (1.10)	9.03 (1.66)
Median [Min, Max]	8.86 [3.23, 15.2]	8.86 [4.75, 15.2]	9.33 [6.65, 13.6]	8.86 [3.23, 15.2]
Age of Teacher				
Under 25	660 (4.2%)	23 (0.9%)	0 (0%)	683 (3.8%)
25–29	2020 (12.9%)	200 (8.2%)	13 (8.6%)	2233 (12.3%)
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50–59	3357 (21.5%)	711 (29.3%)	21 (13.8%)	4089 (22.5%)
60 or more	321 (2.1%)	144 (5.9%)	28 (18.4%)	493 (2.7%)
Level of Formal Education Completed				
Post-secondary, non-tertiary education	9 (0.1%)	0 (0%)	0 (0%)	9 (0.0%)
Short-cycle tertiary education	6 (0.0%)	0 (0%)	0 (0%)	6 (0.0%)
Bachelor's or equivalent	10894 (69.8%)	1525 (62.8%)	151 (99.3%)	12570 (69.1%)
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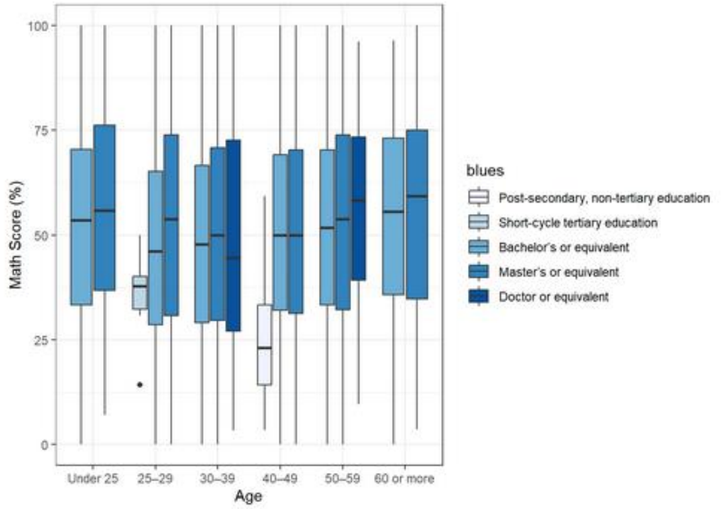
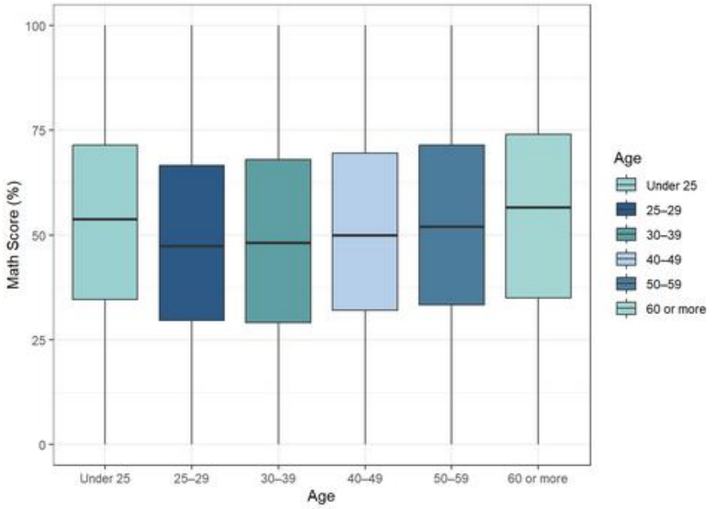
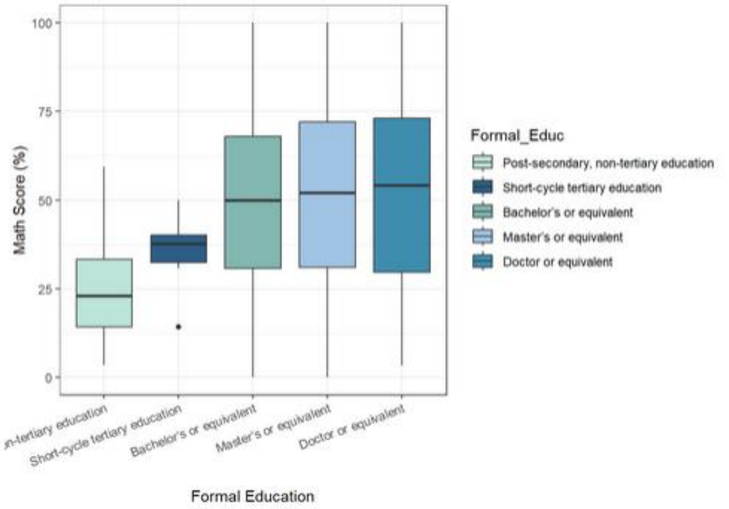
Descriptive Statistics



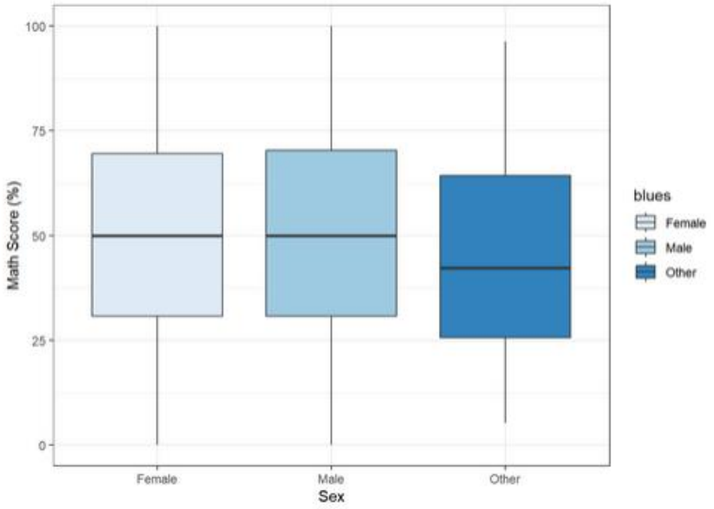
(a) Boxplots of Students' Math Scores by Teachers Age and Education Level



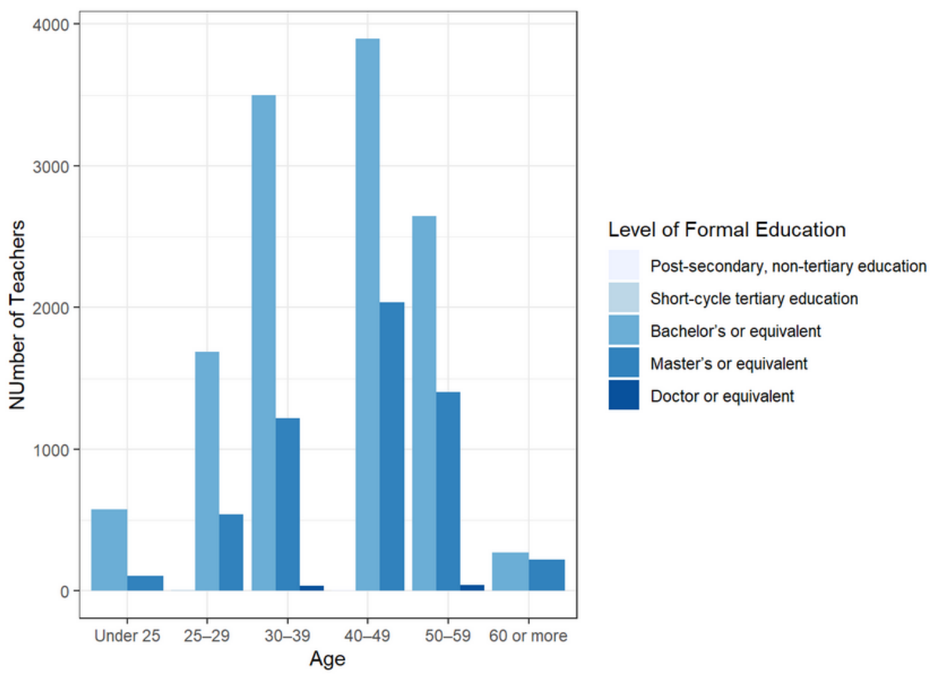
(b) Boxplots of Students' Math Scores by Age of Teachers



(c) Boxplots of Scores Students' Math Scores by Teacher's Level of Education



(d) Boxplots of Students' Math Scores by Sex of Teachers



Number of Teachers by Age and Education Level

Correlation Heatmap for Teacher-Level Analysis

Step-wise Regression Analysis

(a) Teacher Level Regression Coefficients

term	estimate	std.error	statistic	p.value
(Intercept)	10.629	8.066	1.318	0.188
Years_Teaching	0.126	0.035	3.630	0.000
SexMale	-0.954	0.524	-1.821	0.069
SexOther	-2.961	1.946	-1.521	0.128
Age25–29	-4.207	1.040	-4.043	0.000
Age30–39	-4.796	1.012	-4.740	0.000
Age40–49	-4.445	1.103	-4.030	0.000
Age50–59	-4.594	1.266	-3.627	0.000
Age60 or more	-1.792	1.612	-1.112	0.266
Formal_EducShort-cycle tertiary education	6.473	12.460	0.519	0.603
Formal_EducBachelor's or equivalent	15.930	7.878	2.022	0.043
Formal_EducMaster's or equivalent	17.157	7.884	2.176	0.030
Formal_EducDoctor or equivalent	17.543	8.317	2.109	0.035
Class_Size	0.189	0.031	6.099	0.000
Homework_FreqLess than once a week	0.458	0.501	0.915	0.360
Homework_Freq1 or 2 times a week	3.250	0.474	6.853	0.000
Homework_Freq3 or 4 times a week	2.174	0.566	3.842	0.000
Homework_FreqEvery day	2.930	0.700	4.185	0.000
Academic_Success	1.574	0.101	15.644	0.000
Safe_Orderly_Schools	-0.366	0.101	-3.604	0.000
Job_Satis	-0.644	0.093	-6.941	0.000
Student_not_Ready	1.376	0.125	11.039	0.000
Math_MajorMajor in Edu but not Math	1.014	0.540	1.880	0.060
Math_MajorMajor in Math but not Edu	4.197	1.365	3.075	0.002
Math_MajorAll other Majors	-0.213	0.681	-0.312	0.755
Instruction_Hours	0.159	0.095	1.667	0.096

(b) Teacher Level Model Summary Statistics

r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.residual	nobs
0.047	0.045	23.553	35.505	0	25	-83282.86	166619.7	166830.6	10078858	18168	18194

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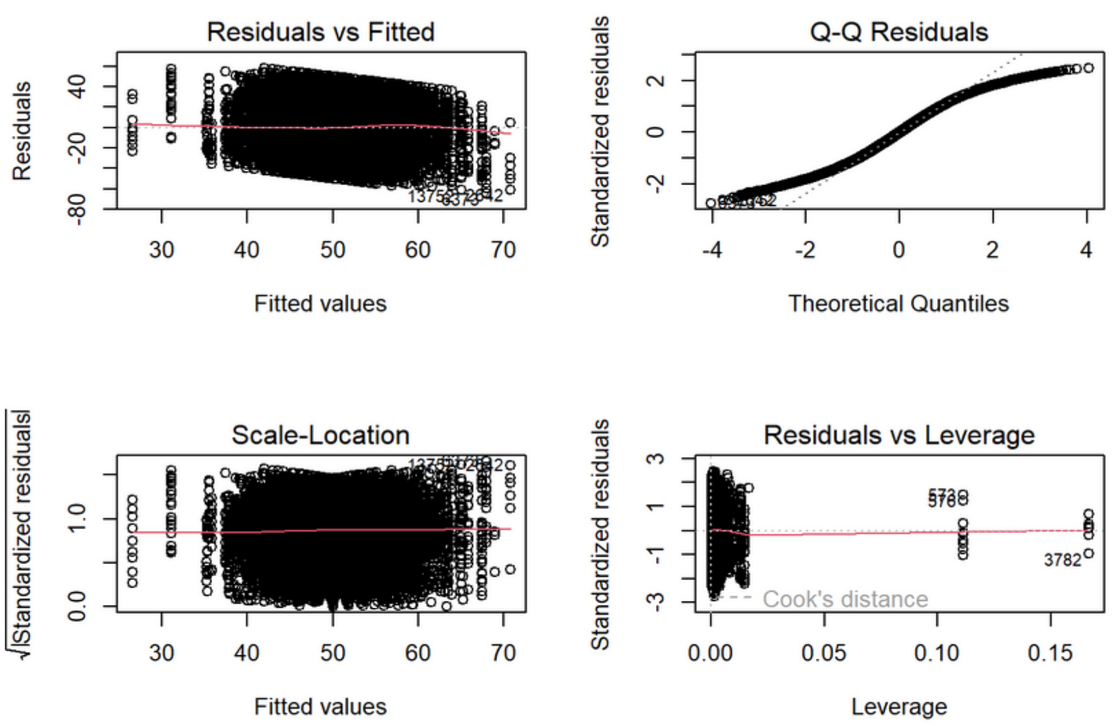
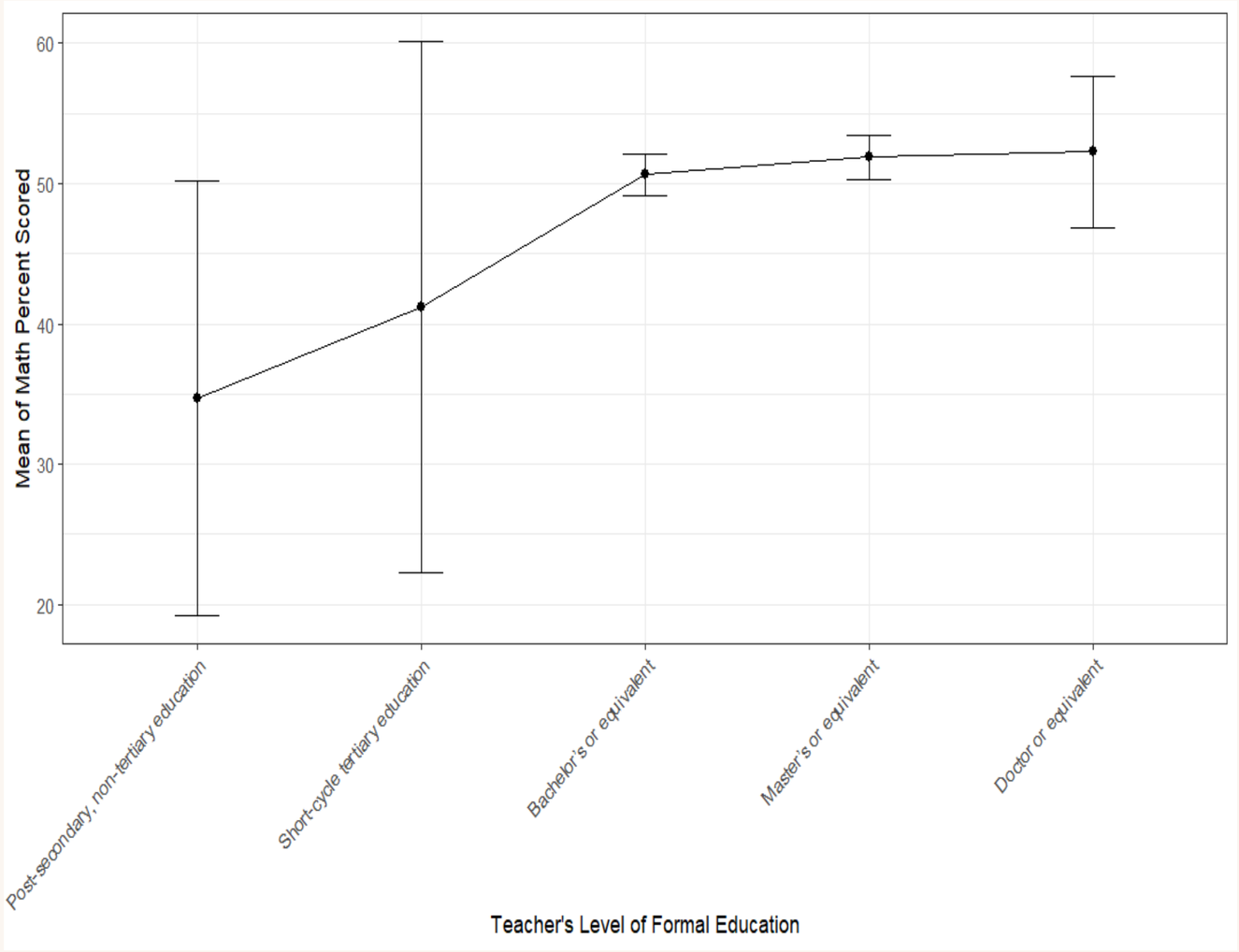


Figure 10: Residual Plots for the Teacher-Level Regression Model

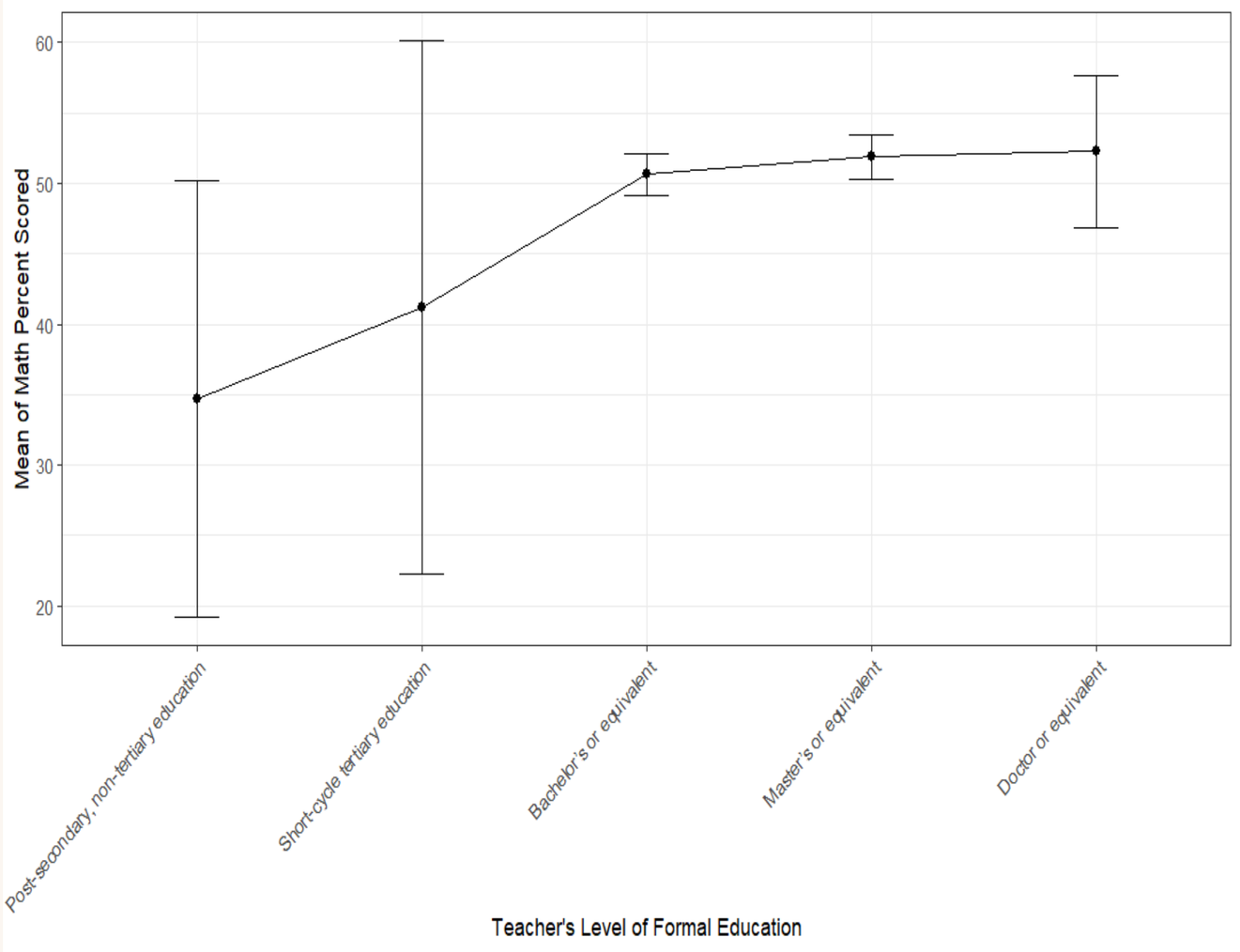
Key-Takeaway

- Despite most of the predictors being significant, they explain a relatively small proportion of variation in math scores suggesting that many additional factors (curriculum, school resources) are likely to contribute to students' performances.

Pairwise Comparisons using Education Level



Pairwise Comparisons using Education Level



Hypothesis:

$H_0: \mu_1 = \mu_2 = \mu_3 = u_4 = \mu_5 = 0$

$H_1: At\ least\ one\ group\ mean\ is\ dif\ ferent$

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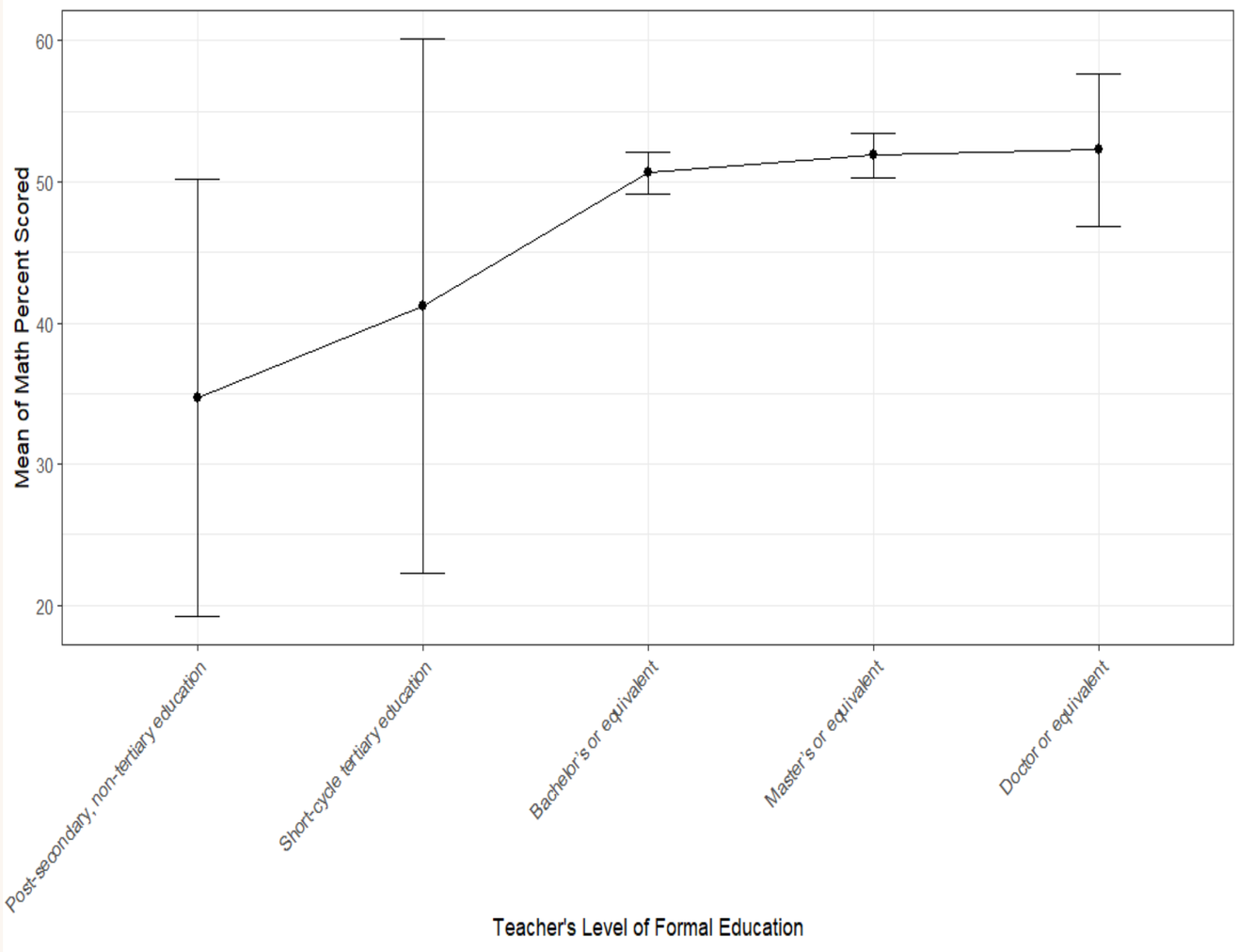

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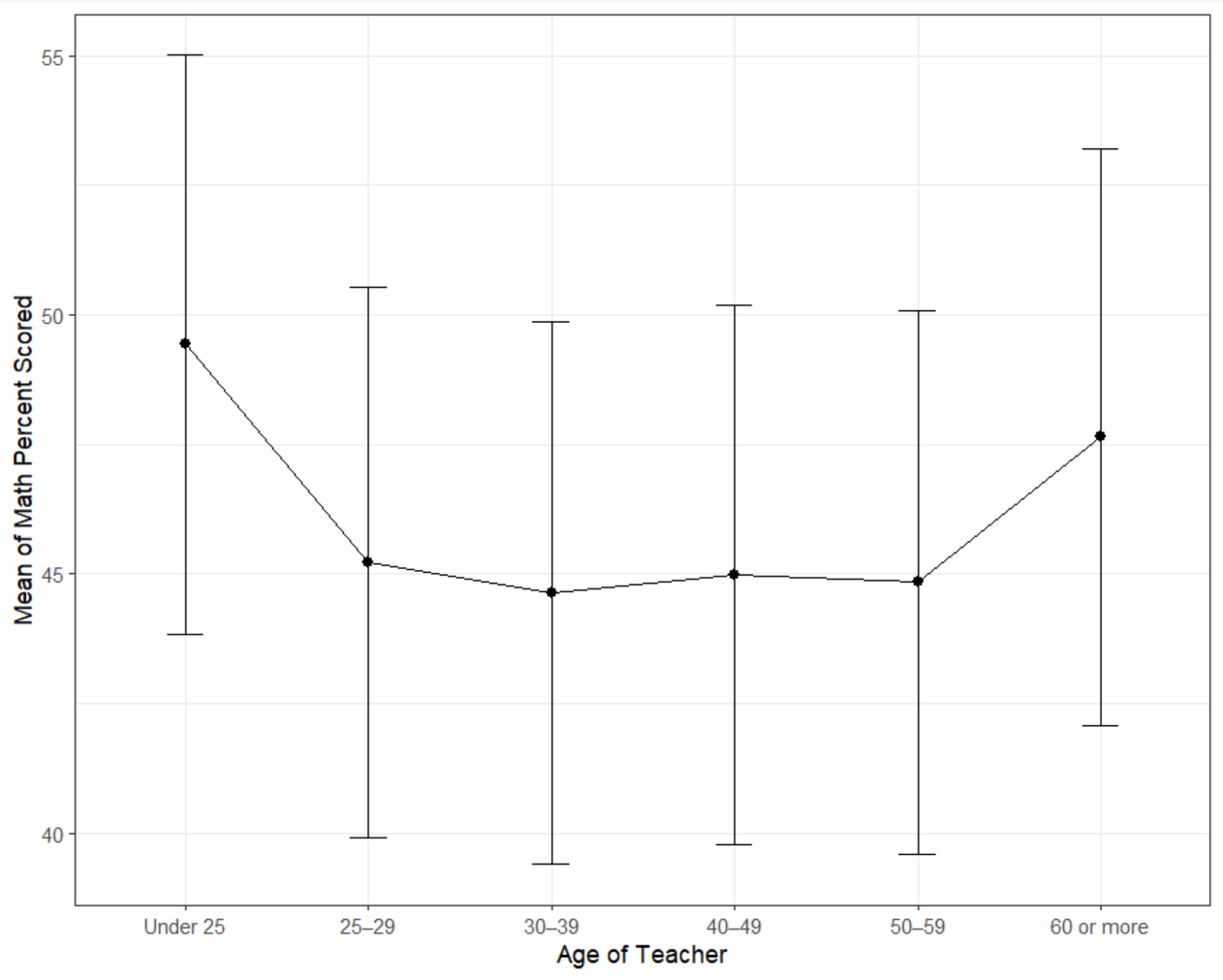
$H_1: At\ least\ one\ group\ mean\ is\ different$

Level1	Level2	Difference	SE	CI_low	CI_high	t	df	p
Short-cycle tertiary education	Post-secondary, non-tertiary education	6.473	12.460	-17.950	30.895	0.519	18168	1.000
Bachelor's or equivalent	Post-secondary, non-tertiary education	15.930	7.878	0.487	31.372	2.022	18168	0.432
Master's or equivalent	Post-secondary, non-tertiary education	17.157	7.884	1.704	32.609	2.176	18168	0.295
Doctor or equivalent	Post-secondary, non-tertiary education	17.543	8.317	1.240	33.845	2.109	18168	0.349
Bachelor's or equivalent	Short-cycle tertiary education	9.457	9.646	-9.450	28.364	0.980	18168	1.000
Master's or equivalent	Short-cycle tertiary education	10.684	9.650	-8.231	29.599	1.107	18168	1.000
Doctor or equivalent	Short-cycle tertiary education	11.070	9.997	-8.525	30.665	1.107	18168	1.000
Master's or equivalent	Bachelor's or equivalent	1.227	0.396	0.450	2.004	3.095	18168	0.020
Doctor or equivalent	Bachelor's or equivalent	1.613	2.651	-3.582	6.808	0.609	18168	1.000
Doctor or equivalent	Master's or equivalent	0.386	2.663	-4.834	5.606	0.145	18168	1.000

Pairwise Comparisons using Age



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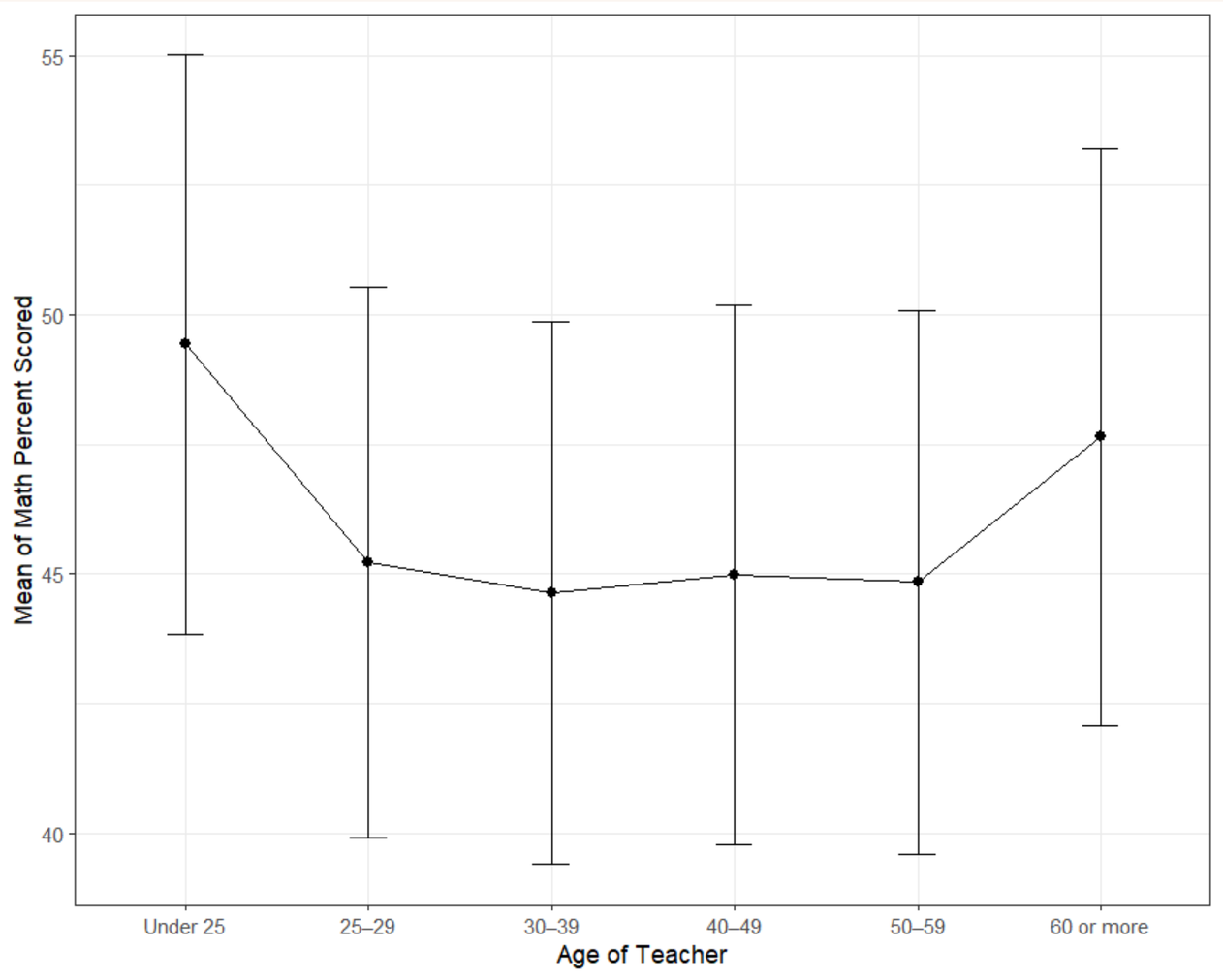

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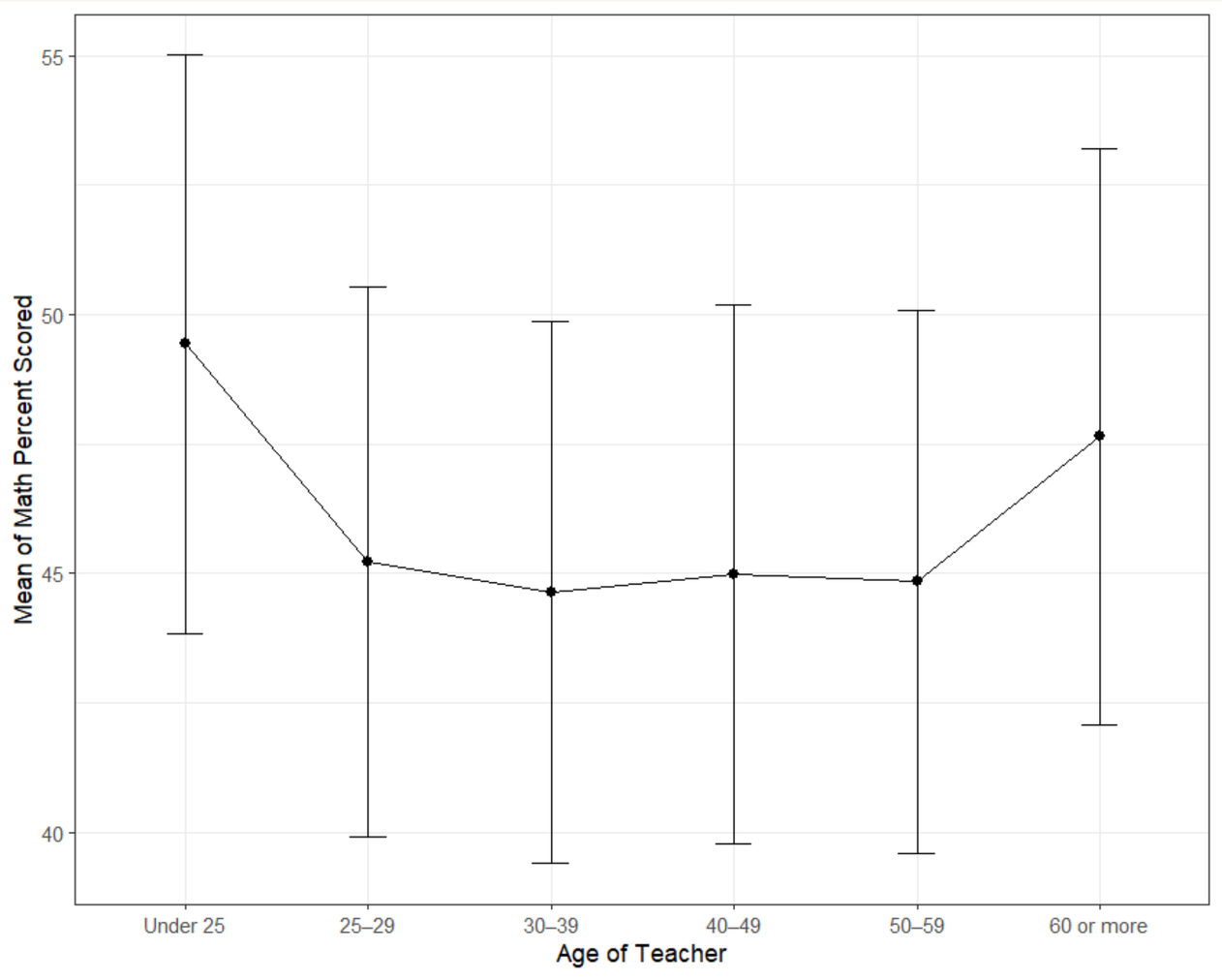

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$H_1: At\ least\ one\ group\ mean\ is\ dif\,ferent$

Level1	Level2	Difference	SE	CI_low	CI_high	t	df	p
25–29	Under 25	-4.207	1.040	-6.247	-2.168	-4.043	18168	0.001
30–39	Under 25	-4.796	1.012	-6.780	-2.813	-4.740	18168	0.000
40–49	Under 25	-4.445	1.103	-6.607	-2.283	-4.030	18168	0.001
50–59	Under 25	-4.594	1.266	-7.076	-2.111	-3.627	18168	0.004
60 or more	Under 25	-1.792	1.612	-4.951	1.368	-1.112	18168	1.000
30–39	25–29	-0.589	0.635	-1.833	0.655	-0.928	18168	1.000
40–49	25–29	-0.238	0.738	-1.684	1.208	-0.322	18168	1.000
50–59	25–29	-0.387	0.943	-2.235	1.462	-0.410	18168	1.000
60 or more	25–29	2.415	1.374	-0.279	5.109	1.757	18168	1.000
40–49	30–39	0.351	0.529	-0.685	1.388	0.665	18168	1.000
50–59	30–39	0.203	0.725	-1.219	1.624	0.279	18168	1.000
60 or more	30–39	3.004	1.240	0.575	5.434	2.424	18168	0.231
50–59	40–49	-0.149	0.549	-1.225	0.927	-0.271	18168	1.000
60 or more	40–49	2.653	1.148	0.402	4.904	2.310	18168	0.313
60 or more	50–59	2.802	1.141	0.566	5.038	2.456	18168	0.211

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- Only students who had teachers with a masters' vs bachelors degrees had significant difference in scores.
- Students with teachers less than 25 seemed to have students who scored higher than all other age groups.

Presented by Henrietta Kadi

Thank you!