**Background**

Research consistently shows that human capital measures frequently used in teacher evaluation and compensation explain little of a teacher's contribution to student academic growth (Aaronson et al., 2007) and require greater nuance. For example, whereas some researchers detect no relationship between teacher’s education attainment or experience and student performance (Aaronson et al., 2007), some find evidence that teachers who obtain a graduate degree improve student learning early in their career (Guarino et al., 2013; Papay and Kraft, 2015) – though those returns later decline and even turn negative with time (Rockoff, 2004). Research also shows that the relations between teacher experience and student learning vary across levels of education (Harris and Sass, 2011) and subject area (Clotfelter et al., 2007). Most importantly, the relationships observed between teacher characteristics and change in student learning are unstable because they are often biased: higher performing and more motivated students often have more access to teachers with higher human capital profiles.

**Significance**

Our study contributes to a rigorous literature body that examines the causal impact of teacher education attainment and experience on student academic outcomes. We prioritize accuracy and precision in four ways. First, we effectively address threats to internal validity by leveraging a random assignment of teachers to students enforced by a 2006 Chinese national policy. Second, given random assignment, we are able to use between-teacher variation to estimate teacher effects (see Ladd and Sorensen, 2017; Papay and Kraft, 2015). Third, we model teacher education attainment and experience in different formats (continuous and categorical) to understand beyond their linear effects on student outcomes. Fourth, we control for school fixed-effects to account for systematic difference across schools and a rich set of student-, homeroom-, and teacher-level covariates to improve estimation precision. Here, the most important is the cubic polynomial functions of four scores (in three core content subjects and cognitive test) in prior years that effectively absorb varying functional forms of student prior learning ability and school and family inputs.

**Research Questions**

We answer two research questions:

1. Whether and to what extent teacher education attainment impacts student academic performance and confidence?
2. Whether and to what extent teacher teaching experience impacts student academic performance and confidence?

**Data and Measures**

We draw our sample from China Education Panel Survey (CEPS), China’s first nationally representative, longitudinal data of middle school students (more details in Appendix A Data Description). We restrict the sample to 7th graders in 63 public schools that enforced random assignment of teachers to students from 2013-14 to 2014-15 (follow-up rate 91.93%). Note that we do not worry about across-school sorting because school fixed effects absorb any time-invariant factors that drive students sorting in or out of school.

We obtain three separate samples by matching students with their Chinese, English, and math teachers. Missing rate on all key variables was below 2% except for two variables, teacher experience and student age, which were missing at 2-3%. We dropped all observations that had any missing value on predictor and outcome variables and replaced missing values on other variables with leave-one-out mean within homeroom (for student variables) or school (for teacher variables). We are left with 4,754, 4,855, and 4,887 students in Chinese, English, and math sample, respectively. Summary statistics of key variables are presented in Table 1.

***Predictor variables***. Teacher education attainment is measured by three variables: education in years, an indicator for graduate degree, and an indicator for major in Educational Studies. Teacher experience is also measured by experience in years and a categorical binned experience variable. The distributions of student observations by teacher education and experience are displayed in Figure 1 and 2, showing that the majority of teachers hold a bachelor degree (16 years of education) and have 15-25 years of experience.

***Outcome variables***. In each subject, we inspect two unique aspects of student academic status: performance measured by student’s score on the school-administered mid-fall semester exam from school record and self-reported confidence level measured on a 4-point Likert scale in student survey (from very low to very high). Both are standardized within each school.

**Methods**

We conduct a series of student baseline covariates balance check on teacher education and experience and show in Table 2 that none of the four baseline scores is correlated with teacher education or experience, with few significant values likely due to sampling idiosyncrasy.

Provided random assignment confirmed by policy and school, we argue that the variation in pre-treatment teacher characteristics such as education or experience is independent from any observed and unobserved factors that also impact student outcomes. We determine the causal impact of education or experience by estimating an ordinary least squares (OLS) regression model (included in Appendix B).

**Results**

***Teacher education effects***. Teacher education attainment does not have a persistent effect on student score or confidence and when it does, its effects vary by subject area. We find: 1) among the three education measures, major in Educational Studies does not seem to matter; 2) across all three subjects, English performance or confidence do not respond to teacher education at all; 3) Chinese teachers with a graduate degree improve student confidence by 0.384 SD; and 4) teacher education in years impacts student confidence in math negatively: one year increase (within 14-19 range) in math teacher’s education corresponds to 0.141 SD decrease in student confidence (similarly, holding a graduate degree decreases math score by 0.202 SD).

***Teacher experience effects***. Teacher experience in years does not have a direct impact on student academic outcomes but the indicator variable models (Clotfelter et al., 2007; Harris and Sass, 2011) uncover a non-linear pattern of teacher experience effects: compared to newly onboard teachers (0-1 years), more experienced teachers (4+ years) decrease student English and math scores as well as Chinese confidence.  Overall, it is evident that teachers are more productive in their early career but once they finish one “cycle” (core content teachers typically follow students from grade 7 through 9 to finish a “cycle” of experience), their productivities decline, although this pattern does not apply to Chinese score and confidence in English and math.

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**Tables and Figures**

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Table 1. Summary statistics of analytic samples

|  |  |  |  |
| --- | --- | --- | --- |
|  | Chinese Sample | English Sample | Math Sample |
| Key Variables | N = 4,754 | N = 4,855 | N = 4,887 |
| ***Predictor Variables*** |  |  |  |
| Education (years) | 15.93 (14.00, 19.00) | 15.87 (14.00, 19.00) | 15.88 (14.00, 19.00) |
| Graduate degree | 118 / 4,754 (2.5%) | 115 / 4,855 (2.4%) | 128 / 4,887 (2.6%) |
| Education major | 4,549 / 4,754 (96%) | 4,216 / 4,855 (87%) | 4,577 / 4,887 (94%) |
| Experience (years) | 16 (1, 35) | 17 (1, 34) | 17 (1, 39) |
| Experience (binned) |  |  |  |
| 0-1 year (omitted) | 107 / 4,754 (2.3%) | 90 / 4,855 (1.9%) | 36 / 4,887 (0.7%) |
| 2-3 years | 271 / 4,754 (5.7%) | 249 / 4,855 (5.1%) | 192 / 4,887 (3.9%) |
| 4-6 years | 301 / 4,754 (6.3%) | 374 / 4,855 (7.7%) | 242 / 4,887 (5.0%) |
| 7-9 years | 586 / 4,754 (12%) | 388 / 4,855 (8.0%) | 481 / 4,887 (9.8%) |
| 10-12 | 542 / 4,754 (11%) | 624 / 4,855 (13%) | 555 / 4,887 (11%) |
| 13-15 | 489 / 4,754 (10%) | 412 / 4,855 (8.5%) | 673 / 4,887 (14%) |
| 16-24 | 1,717 / 4,754 (36%) | 1,614 / 4,855 (33%) | 1,760 / 4,887 (36%) |
| 25+ | 741 / 4,754 (16%) | 1,104 / 4,855 (23%) | 948 / 4,887 (19%) |
| ***Outcome Variables*** |  |  |  |
| Score | 0.01 (-6.74, 2.24) | 0.02 (-5.52, 3.70) | 0.01 (-6.54, 3.14) |
| Confidence | 0.00 (-3.20, 2.40) | 0.00 (-3.20, 3.15) | 0.00 (-3.02, 3.31) |

Notes: Cells report mean and range for continuous variables and count and percentage of each category for dichotomous and categorical variables.

Table 2. Covariates balance check

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Chinese Sample | | English Sample | | Math Sample | |
|  | Education (years) | Experience (years) | Education (years) | Experience (years) | Education (years) | Experience (years) |
|  | | | | | | |
| Baseline Chinese | 0.016 | 0.098 | -0.015 | -0.068 | -0.037 | -0.109 |
|  | (0.025) | (0.228) | (0.023) | (0.177) | (0.023) | (0.233) |
| Baseline English | -0.018 | 0.251 | 0.054 | -0.065 | 0.050 | 0.125 |
|  | (0.028) | (0.329) | (0.029) | (0.233) | (0.027) | (0.279) |
| Baseline math | 0.035 | -0.287 | -0.038 | 0.167 | 0.003 | -0.056 |
|  | (0.020) | (0.296) | (0.028) | (0.206) | (0.023) | (0.245) |
| Baseline cognitive | -0.016 | -0.013 | 0.022 | 0.273 | -0.003 | -0.073 |
|  | (0.020) | (0.317) | (0.029) | (0.207) | (0.015) | (0.296) |
| Female student | -0.014 | 0.053 | -0.016 | 0.274\* | -0.017 | 0.070 |
|  | (0.014) | (0.143) | (0.016) | (0.125) | (0.015) | (0.178) |
| Age | 0.009 | -0.497 | -0.013 | 0.100 | 0.011 | -0.108 |
|  | (0.014) | (0.297) | (0.026) | (0.161) | (0.017) | (0.239) |
| Only child | -0.013 | 0.055 | -0.003 | -0.360\* | -0.026 | 0.145 |
|  | (0.018) | (0.182) | (0.013) | (0.157) | (0.015) | (0.208) |
| Rural residency | 0.017 | 0.282 | 0.008 | -0.292 | -0.025 | -0.087 |
|  | (0.022) | (0.153) | (0.013) | (0.187) | (0.018) | (0.230) |
| Migrant worker family | -0.015 | 0.321 | 0.021 | -0.178 | 0.019 | -0.225 |
|  | (0.027) | (0.198) | (0.022) | (0.177) | (0.015) | (0.274) |
| Mother education (years) | 0.001 | -0.010 | -0.002 | -0.009 | -0.003 | 0.049 |
|  | (0.003) | (0.033) | (0.003) | (0.023) | (0.003) | (0.041) |
| Father education (years) | 0.005 | 0.053 | -0.002 | 0.008 | -0.0003 | -0.016 |
|  | (0.003) | (0.035) | (0.002) | (0.024) | (0.002) | (0.033) |
| Family income | -0.005 | 0.003 | 0.011 | 0.146 | 0.061\* | -0.527\* |
|  | (0.021) | (0.275) | (0.022) | (0.146) | (0.024) | (0.227) |
|  | | | | | | |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes |
| F-Statistics | 0.854 (df = 12; 61) | 1.449 (df = 12; 61) | 1.002 (df = 12; 62) | 1.986\* (df = 12; 62) | 1.127 (df = 12; 62) | 1.127 (df = 12; 62) |
| Observations | 4,754 | 4,754 | 4,855 | 4,855 | 4,887 | 4,887 |
| R2 | 0.615 | 0.547 | 0.647 | 0.772 | 0.622 | 0.539 |

Notes: \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05. Cells report coefficients and associated standard errors in parentheses. Each column reports results of a separate OLS regression where the predictor variables (teacher education and experience) is regressed on baseline student prior score measures and characteristics. All models control for school fixed effects and cluster standard errors at school level.

Table 3. The causal impacts of teacher educational background on student academic outcomes

Panel A. Teacher education (in years) on student performance

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | | | | | | | |
|  | Chinese score | | | English score | | | Math score | | |
|  | | | | | | | | | |
| Education (years) | 0.059 | 0.049 | 0.046 | 0.026 | 0.019 | 0.025 | -0.027 | -0.019 | -0.021 |
| (0.044) | (0.049) | (0.065) | (0.025) | (0.023) | (0.018) | (0.026) | (0.033) | (0.033) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.612 | 0.615 | 0.615 | 0.710 | 0.710 | 0.711 | 0.618 | 0.619 | 0.622 |

Panel B. Graduate degree on student performance

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | |
|  |  | | | | | | | | |
|  | Chinese score | | | English score | | | Math score | | |
|  | | | | | | | | | |
| Graduate degree | 0.249 | 0.261 | 0.258 | 0.031 | 0.009 | 0.051 | -0.229\*\* | -0.236\* | -0.202\* |
| (0.203) | (0.186) | (0.214) | (0.061) | (0.062) | (0.046) | (0.085) | (0.116) | (0.083) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.612 | 0.615 | 0.616 | 0.709 | 0.710 | 0.711 | 0.618 | 0.620 | 0.622 |

Panel C. Major in Educational Studies on student performance

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | |
|  |  | | | | | | | | |
|  | Chinese score | | | English score | | | Math score | | |
|  | | | | | | | | | |
| Major in Educational  Studies | 0.302\*\* | 0.258 | 0.223 | -0.019 | -0.044 | -0.040 | 0.042 | 0.029 | 0.076 |
| (0.105) | (0.160) | (0.170) | (0.072) | (0.076) | (0.052) | (0.104) | (0.102) | (0.074) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.612 | 0.615 | 0.615 | 0.709 | 0.710 | 0.711 | 0.618 | 0.619 | 0.622 |

Panel D. Teacher education (in years) on student confidence

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | | | | | | | |
|  | Chinese confidence | | | English confidence | | | Math confidence | | |
|  | | | | | | | | | |
| Education (years) | 0.028 | 0.015 | 0.023 | 0.002 | -0.017 | -0.008 | -0.075\* | -0.135\*\*\* | -0.141\*\*\* |
| (0.074) | (0.066) | (0.050) | (0.029) | (0.030) | (0.032) | (0.033) | (0.036) | (0.038) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.078 | 0.082 | 0.086 | 0.259 | 0.263 | 0.267 | 0.240 | 0.246 | 0.247 |

Panel E. Graduate degree on student confidence

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | |
|  |  | | | | | | | | |
|  | Chinese confidence | | | English confidence | | | Math confidence | | |
|  | | | | | | | | | |
| Graduate degree | 0.331 | 0.336 | 0.384\* | 0.069 | -0.006 | 0.060 | -0.043 | -0.153 | -0.139 |
| (0.191) | (0.174) | (0.155) | (0.108) | (0.158) | (0.164) | (0.094) | (0.165) | (0.174) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.079 | 0.083 | 0.088 | 0.259 | 0.263 | 0.267 | 0.239 | 0.243 | 0.244 |

Panel F. Major in Educational Studies on student confidence

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | |
|  |  | | | | | | | | |
|  | Chinese confidence | | | English confidence | | | Math confidence | | |
|  | | | | | | | | | |
| Major in Educational  Studies | 0.429\*\* | 0.424\* | 0.288 | -0.022 | -0.052 | -0.045 | -0.106 | -0.099 | -0.084 |
| (0.128) | (0.185) | (0.214) | (0.093) | (0.097) | (0.049) | (0.136) | (0.111) | (0.109) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.080 | 0.084 | 0.087 | 0.259 | 0.263 | 0.267 | 0.239 | 0.243 | 0.244 |

Notes: \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05. Cells report coefficients and associated standard errors in parentheses. Each column presents results of a separate OLS regression where student outcome is regressed against teacher education attainment measures. For each sample, the outcome variable is estimated three times: the first model controls for student covariates that include cubic polynomial functions of baseline Chinese, English, math, and CEPS cognitive test scores, and student characteristics; the second model adds homeroom covariates that include homeroom size and averaged student characteristics at homeroom level; the third model further adds teacher gender and homeroom advisor status. All models also control for school fixed effects and cluster standard errors at school level.

Table 4. The causal impacts of teacher experience on student academic outcomes

Panel A. Teacher experience (in years) on student performance

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | | | | | | | |
|  | Chinese score | | | English score | | | Math score | | |
|  | | | | | | | | | |
| Experience (in years) | -0.002 | -0.00004 | 0.002 | -0.003 | -0.002 | -0.004 | -0.004 | -0.005 | -0.004 |
| (0.004) | (0.004) | (0.004) | (0.003) | (0.003) | (0.002) | (0.002) | (0.003) | (0.002) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.611 | 0.614 | 0.615 | 0.710 | 0.710 | 0.712 | 0.618 | 0.620 | 0.622 |

Panel B. Teacher experience (binned) on student performance (compared to teachers with 0-1 year experience)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | |
|  |  | | | | | | | | |
|  | Chinese score | | | English score | | | Math score | | |
|  | | | | | | | | | |
| 2-3 years | -0.111 | 0.143 | 0.209 |  |  |  | 0.218 |  |  |
| (0.366) | (0.312) | (0.359) | (0.000) | (0.000) | (0.000) | (0.131) | (0.000) | (0.000) |
| 4-6 years | 0.019 | 0.196 | 0.247 | -0.164 | -0.213 | -0.230\* |  | -0.284 | -0.245\* |
|  | (0.184) | (0.192) | (0.203) | (0.127) | (0.108) | (0.108) | (0.000) | (0.147) | (0.111) |
| 7-9 years | -0.029 | 0.168 | 0.242 | -0.232 | -0.256\* | -0.357\*\* | 0.216\*\*\* | -0.119 | -0.102 |
|  | (0.221) | (0.228) | (0.225) | (0.127) | (0.109) | (0.111) | (0.059) | (0.148) | (0.110) |
| 10-12 years | -0.137 | 0.020 | 0.105 | -0.183 | -0.162 | -0.237\* | 0.078 | -0.245 | -0.215\* |
|  | (0.176) | (0.195) | (0.198) | (0.122) | (0.112) | (0.105) | (0.066) | (0.154) | (0.107) |
| 13-15 years | -0.093 | 0.070 | 0.168 | -0.190 | -0.187 | -0.283\*\* | -0.030 | -0.288 | -0.267\* |
|  | (0.175) | (0.174) | (0.184) | (0.143) | (0.125) | (0.104) | (0.077) | (0.148) | (0.106) |
| 16-24 years | -0.098 | 0.102 | 0.184 | -0.221 | -0.260\* | -0.341\*\* | -0.021 | -0.309\* | -0.281\*\* |
|  | (0.177) | (0.195) | (0.200) | (0.127) | (0.116) | (0.106) | (0.038) | (0.146) | (0.102) |
| 25+ years | -0.116 | 0.104 | 0.217 | -0.244 | -0.245\* | -0.343\*\* | 0.043 | -0.251 | -0.207 |
|  | (0.165) | (0.189) | (0.197) | (0.137) | (0.121) | (0.113) | (0.053) | (0.143) | (0.108) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.612 | 0.615 | 0.616 | 0.710 | 0.711 | 0.712 | 0.621 | 0.622 | 0.624 |

Panel C. Teacher experience (in years) on student confidence

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | | | | | | | |
|  | Chinese confidence | | | English confidence | | | Math confidence | | |
|  | | | | | | | | | |
| Experience (in years) | -0.005 | -0.003 | -0.0001 | 0.003 | 0.001 | -0.003 | -0.004 | -0.002 | -0.002 |
| (0.006) | (0.005) | (0.005) | (0.004) | (0.003) | (0.003) | (0.004) | (0.004) | (0.003) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.078 | 0.082 | 0.086 | 0.259 | 0.263 | 0.267 | 0.239 | 0.243 | 0.244 |

Panel D. Teacher experience (binned) on student confidence (compared to teachers with 0-1 year experience)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | |
|  |  | | | | | | | | |
|  | Chinese confidence | | | English confidence | | | Math confidence | | |
|  | | | | | | | | | |
| 2-3 years | -0.232 | 0.019 | 0.020 |  |  |  | 0.100 |  |  |
| (0.363) | (0.390) | (0.308) | (0.000) | (0.000) | (0.000) | (0.241) | (0.000) | (0.000) |
| 4-6 years | -0.686\*\*\* | -0.532\*\*\* | -0.508\*\*\* | -0.052 | -0.149 | -0.180 |  | -0.282 | -0.267 |
|  | (0.112) | (0.140) | (0.117) | (0.126) | (0.163) | (0.153) | (0.000) | (0.246) | (0.239) |
| 7-9 years | -0.599\*\*\* | -0.442\*\* | -0.334\* | -0.014 | -0.065 | -0.217 | 0.266 | -0.014 | -0.006 |
|  | (0.144) | (0.156) | (0.139) | (0.145) | (0.167) | (0.167) | (0.173) | (0.241) | (0.240) |
| 10-12 years | -0.487\*\*\* | -0.303 | -0.206 | -0.00002 | -0.054 | -0.154 | 0.130 | -0.136 | -0.123 |
|  | (0.106) | (0.153) | (0.146) | (0.099) | (0.149) | (0.161) | (0.147) | (0.228) | (0.222) |
| 13-15 years | -0.588\*\*\* | -0.454\*\* | -0.367\*\* | 0.024 | -0.012 | -0.157 | -0.088 | -0.259 | -0.250 |
|  | (0.067) | (0.132) | (0.108) | (0.134) | (0.159) | (0.158) | (0.135) | (0.218) | (0.204) |
| 16-24 years | -0.591\*\*\* | -0.446\*\* | -0.363\*\* | 0.035 | -0.116 | -0.227 | -0.081 | -0.323 | -0.311 |
|  | (0.082) | (0.147) | (0.128) | (0.115) | (0.154) | (0.161) | (0.117) | (0.217) | (0.211) |
| 25+ years | -0.514\*\*\* | -0.311\* | -0.176 | 0.003 | -0.128 | -0.261 | -0.005 | -0.153 | -0.135 |
|  | (0.067) | (0.146) | (0.145) | (0.128) | (0.163) | (0.162) | (0.136) | (0.215) | (0.207) |
|  | | | | | | | | | |
| Student Covariates | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Homeroom Covariates | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Teacher Covariates | No | No | Yes | No | No | Yes | No | No | Yes |
| School FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| School-clustered SE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,754 | 4,754 | 4,754 | 4,855 | 4,855 | 4,855 | 4,887 | 4,887 | 4,887 |
| R2 | 0.083 | 0.087 | 0.092 | 0.259 | 0.264 | 0.267 | 0.244 | 0.248 | 0.248 |

Notes: \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05. Cells report coefficients and associated standard errors in parentheses. Each column presents results of a separate OLS regression where student outcome is regressed against teacher experience measures. For each sample, the outcome variable is estimated three times: the first model controls for student covariates that include cubic polynomial functions of baseline Chinese, English, math, and CEPS cognitive test scores, and student characteristics; the second model adds homeroom covariates that include homeroom size and averaged student characteristics at homeroom level; the third model further adds teacher gender and homeroom advisor status. All models also control for school fixed effects and cluster standard errors at school level.

**Appendix A. Data Description**

The China Education Panel Survey (CEPS) started in school year 2013-2014 and employed a stratified, four-step random sampling procedure to draw a random sample of middle schools, teachers, and students from the nation. First, they randomly selected 28 school districts/counties with probability proportional to size (PPS) from three stratified sample frames, specifically, 15 districts from 2,870 districts (frame 1) in the nation, 3 districts from 31 districts in Shanghai area (frame 2), and 10 districts from 120 migrant labor concentrated districts (frame 3). Second, within each district, they randomly selected four schools from all schools serving 7th and/or 9th grades with PPS. Third, within each school, they randomly selected two homerooms from 7th grade and another two from 9th grade. Fourth, within each homeroom, they included all students and administered separate surveys to students, parents, homeroom advisory teachers, classroom teachers for three core subjects (math, Chinese, and English), and school administrators.

Using this procedure, the CEPS team surveyed 10,279 7th grade and 9,568 9th grade students in school year 2013-14 and successfully followed up with 9,449 of the original 7th graders (follow-up rate 91.9%) along with 471 new students in school year 2014-15.