Students' teaching career expectations by gender and ability levels in science and math: The role of salary and numeracy skills

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Abstract

Understanding what factors foster young people's aspirations to work as teachers is critical for designing effective recruitment policies; and for ensuring that enough youngsters enter the teaching profession. We examine what factors explain between-country differences in the percentage of 15-year-old students who expect to work as teachers as adults. We focus on two factors: (1) the salaries teachers can expect to earn compared to professionals in science, technology, engineering and mathematics (STEM); and (2) the skill levels teachers have compared to STEM professionals. Relative salaries indicate if (and to what extent) the financial returns associated with teaching careers are higher or lower than professional STEM careers dominated by men. Relative skills highlight the investment in human capital that teachers are expected to make to be able to enter the profession, as well as the social and cultural status that is associated with teaching. We used data from 29 countries that participated in the Programme for International Student Assessment (PISA) and the Survey of Adult Skills (PIAAC). In countries where teacher salaries and numeracy skills were high compared to those commanded by STEM professionals, gender gaps in teaching career expectations were smaller. High-ability students in science and mathematics were more likely to expect to work as teachers in countries where teachers have comparatively higher numeracy skills. Our findings show that when teacher salaries are competitive in relationship to the salaries of STEM professionals, more students overall expect to work as teachers. However, whilst low- and middle-performing students in science and mathematics were attracted by economic incentives, high-performing students in science and mathematics were not.

KEYWORDS: teaching career expectation; mathematics and science; teacher salary; social status of the teaching profession; STEM

1 INTRODUCTION

Over the past few years, a broad consensus has emerged on the importance of teacher quality for student outcomes (Hanushek, Piopiunik, & Wiederhold, 2018; Meroni, Vera-Toscano, & Costa, 2015). Empirical studies have shown that teacher quality is associated with gains in student achievement, even after accounting for prior student learning and family background (Muñoz, Prather, & Stronge, 2011; Rivikin, Hanushek, & Kain, 2005). As a result, a key question for education systems is how to maximise teacher quality.

In recent years, many countries have experienced a shortage of teachers, in particular of teachers with high academic potential in science and mathematics (Moin, Dorfield, & Schunn, 2005; Schleicher, 2012). A widely-cited McKinsey report on international achievement concludes that *"the top-performing systems we studied recruit their teachers from the top third of each cohort* [of] *graduate*[s] *from their school system"* (Barber & Mourshed, 2007, p. 16). Similarly, Auguste, Kihn and Miller (2010) state that *"in Singapore, Finland, and Korea virtually all teachers come from the top third of the academic cohort, in contrast to the United States, where only about a quarter of new teachers come from the top third"* (p. 5). These studies maintain that differences in the skill level of individuals entering the teaching workforce account for the higher academic performance of these countries in international standardised assessments.

International assessments reveal that student achievement differs widely across countries (e.g. OECD, 2016a) and recent evidence suggests that differences in the numeracy skills of teachers are important determinants of between-country differences in student achievement (Hanushek et al., 2018; Meroni et al., 2015).

A large number of teachers across countries represented in the Organisation for Economic Co-operation and Development (OECD) are women (OECD, 2017c). A feminised teaching force may inhibit young women from choosing a career in science, technology, engineering and mathematics (STEM). A feminised teaching force may inhibit women from succeeding in STEM careers (OECD, 2017c). Some studies have suggested that role models who promote the ability of women in STEM can stimulate the interest of young women in STEM (e.g. Cheryan, Ziegler, Montoya, & Jiang, 2017). Other studies, in turn, have shown that students who are women tend to identify with teachers who are women (Bottia, Stearns, Mickelson, Moller, & Valentino, 2015). The ability of young women to have careers in STEM fields suffers when female teachers express negative attitudes and dispositions towards mathematics; for example, by displaying mathematics anxiety, low levels of mathematics or science self-efficacy and content knowledge (Beilock, Gunderson, Ramirez, & Levine, 2010; Gunderson, Ramirez, Levine, & Beilock, 2012).

The majority of studies examining teaching career choices focused on the circumstances encountered by pre-service teachers or student teachers. Few studies have examined the career interests of secondary school students (Fray & Gore, 2018). Despite an increasing policy focus on the need to attract teaching candidates with strong mathematics and science skills and male candidates (e.g., Auguste et al., 2010; Barber & Mourshed, 2007), little evidence exists on cross-country differences in how attractive the teaching profession is (particularly among groups currently underrepresented in teaching).

We contribute to filling the void in the literature by examining how the conditions, under which teachers work, shape secondary school students' expectations to work in teaching. Moreover, because of the specific policy interest in attracting young men and individuals with strong mathematics and science skills into teaching, we also examine how teaching conditions compare to those experienced by STEM professionals (Elfers, Plecki, John, & Wedel, 2008; Moin et al., 2005), in particular broader economic and social conditions (Fray & Gore, 2018).

We focused on adolescents because this is an age at which individuals start to develop occupational values, interests and preferences (Johnson, 2001; Schulenberg, Vondracek, & Kim, 1993); an understanding of the demands of different occupations (Hartung, Porfeli, & Vondracek, 2005); and feelings of efficacy and performance expectancies in their own abilities in different domains (Eccles, 1994; Eccles, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, 1983; Pajares, 2005). In many countries, adolescence is a time when students and their families need to make decisions about education and future career possibilities and academic preparation in high schools often determine students' college access, majors and career choices (Stephens, Warren, Harner, & Owen, 2015). There is evidence that the career expectations of secondary school students can predict future skill distribution and background characteristics of teachers. At the population level, students' expectations of a teaching career predict rates of entry into teacher training and the teaching profession (OECD, 2018).

Prior research based on the recollections of student teachers and teachers suggests that early expectations of a teaching career play an important role in decisions to enter teacher training and the teaching profession (Richardson & Watt, 2005). Often, the decision to become a teacher is made in secondary school, years before graduating from high school (Brookhart & Freeman, 1992). Prospective studies, which compare early career aspirations with actual careers observed, using follow-up surveys for the same individuals, confirm the importance of adolescent career aspirations for career choices more generally (Ashby & Schoon, 2010). Data from the teacher questionnaire that was administered as an optional component in PISA 2015 provide retrospective evidence on the importance of early career aspirations for the decision to become a teacher, for eighteen countries. In PISA 2015, teachers reported whether pursuing a career in the teaching profession was their goal after completing upper secondary school. On average, about 59% of science teachers and about 68% of other teachers reported that they had already chosen to become teachers by the end of secondary school (OECD, 2018). The literature and the validation conducted using the teacher questionnaire in PISA indicate that self-reports among 15-year-old students are an important factor to examine when assessing factors that shape who may choose a career in teaching.

Our contribution is threefold. First, we examine if teaching career expectations (i.e., whether or not a student expects to work as a teacher) differ by gender and across students of different abilities in science and mathematics. Second, we identify differences in the characteristics of students who expect to work as teachers and those who expect to work as STEM professionals. Third, we explore two factors that characterise the professional context and the social status of teaching and pursuing a career in STEM. Specifically, we compare how the salaries and skills of teachers and STEM professionals contribute to who among students—and how many—aspire to teaching careers.

2 LITERATURE REVIEW

2.1 The career expectations of students

Expectancy-value theory posits that individuals develop occupational interests based on performance expectancies and occupational values (Eccles, 1994; Eccles et al., 1983). Performance expectancies express individuals' beliefs regarding their likelihood of success in an occupation given their overall abilities and fit with occupational demands. Occupational values reflect the perceived importance (utility) of a career, the interest or enjoyment individuals derive from such career, as well as the cost and rewards associated with a career rather than another (Brown, 2002;

Schulenberg, Vondracek & Kim, 1993). Expectancy-value theory predicts that individuals develop preferences for some careers over others because of differences in performance expectancies and occupational values across different careers. Rewards typically considered when evaluating the attractiveness of different occupations include: financial rewards, working conditions, social status and altruistic motives (Schwab, Rynes, & Aldag, 1987).

The "Factors That Influence Teaching Choice" model (FIT-Choice) developed by Watt and Richardson adapts expectancy-value theory to describe the factors that shape individuals' choices to enter the teaching profession (Watt et al., 2012). The FIT-Choice model articulates the importance of alternative opportunities in motivating career choices. It identifies and conceptually separates the following motivational drivers: task demands, task returns, personal utility values, and social utility values. To gain a comprehensive picture of motivational drivers, researchers have considered the degree to which broader economic and social contexts are associated with a student's career choice (Fray & Gore, 2018).

We conceived occupational values as the rewards that are desired from (and experienced in) work. One of the reasons why men and women, high-ability and low-ability students in science and math, are differently represented in the teaching profession is that they may seek occupations that fulfil different values (Weisgram & Bigler, 2006). Whilst men and high-ability students in mathematics and science are underrepresented in the teaching profession, they are overrepresented in STEM professions. Consequently, in this paper we explore which occupational values sustain students' intention to work in teaching among students who would otherwise be likely to choose a career in STEM fields—men and high-ability students in science and mathematics. More specifically, we explore how financial rewards (indicated by relative salaries, that is, a comparison of teacher salaries and salaries in STEM professions), task demands and social prestige (indicated by relative skills, that is, a comparison of numeracy skills of teachers and STEM professionals) are related to students' expectations to work as teachers.

2.2 Teaching salaries and STEM professional salaries

Low salaries are often cited as a key reason for the low attractiveness of the teaching profession, in particular among high-achieving candidates (e.g., Elfers, Plecki, John & Wedel, 2008; OECD, 2018; Park & Byun, 2015). There is some evidence that competitive salaries can improve the attractiveness of teaching careers when compared to careers in engineering or the technology sector in the United States (Elfers et al., 2008) as well as nonteaching professions in Australia, the United Kingdom and Switzerland (Wolter & Denzler, 2004). Higher teacher salaries can promote more 15-year-olds overall to expect a career in teaching. However, the evidence on the role of salaries in shaping the teaching career expectations of adolescents suggests that this is true predominantly among students with low ability in mathematics (Han, Borgonovi, & Guerriero, 2018). We build on this literature and use a unique source of internationally comparable information on the salaries of teachers and of other professionals. Our goal was to identify if relative salaries (i.e., the relationship between teacher and STEM professional salaries) were associated with the expectation to work as teachers, among men and high-achieving students in science and mathematics.

Although there are generally few gender differences in preferences for occupational values, some values are valued more strongly by one gender than the other (Konrad, Ritchie, Lieb, & Corrigall, 2000; Schulenberg et al. 1993). Men typically favour jobs that are characterised by high salaries, power and high prestige (Eccles, 1994; Konrad, Ritchie, Lieb & Corrigall, 2000), whilst women report preferring jobs that allow them to work with or help others, develop their knowledge or skills, and spend time with family (Eccles, 1994; Konrad et al., 2000).

As a result, we predict that greater financial rewards will be associated with more students expecting to work as teachers and smaller gender gaps. However, we do not expect salaries to promote a greater willingness to enter the teaching profession among high-ability students in science and math because of evidence that high-achieving students place greater importance on intrinsic and altruistic work values than extrinsic work values (Sortheix, Chow, & Salmela-Aro, 2015).

2.3 Numeracy skills of teachers and STEM professionals

In countries where teachers have higher literacy and numeracy skills, students tend to perform better in academic subjects (Hanushek et al., 2018; Meroni et al., 2015). Teachers' skills can influence their students not only because they increase their quality as teachers but also because they convey information about how prestigious and demanding the teaching profession is (Hargreaves, 2009; Lankford, Loeb, McEachin, Miller & Wyckoff, 2014). Other things being equal, occupations that require high levels of skills to enter the profession, or to perform occupational duties, are typically regarded as occupations with high social status and prestige (Ingersoll & Merrill, 2011). Teachers' higher academic ability and skills relative to those of other professionals signal the status of teaching (Hargreaves, 2009; Lankford et al., 2014). As more high-ability individuals (defined by SAT scores, standardised test scores widely used for college admission in the United States) choose teaching over other professions, for example, the occupational status of teaching improves (Lankford et al., 2014).

Expectancy-value theory and the FIT-Choice model lead us to predict that in countries where teachers are relatively highly skilled compared to STEM professionals, more students will expect to work as teachers. This is because skills are a marker of social status and prestige, a factor that will make the teaching profession more attractive even though it makes entry into the profession more selective. Consistent with research on gender differences in occupational values, we expect that a high skill demand promotes greater interest among men. Contrary to what a comparison of salaries can indicate, we expect that in countries where relative teacher numeracy skills are higher, higher-achieving students in science and mathematics will be more likely to pursue a career in teaching. This is because high-ability students place greater importance on a high level of prestige and power-related job characteristics. Highly skilled individuals can also perceive higher skills demands as an indication that the occupational context in teaching will be stimulating and will reward their abilities. We have used unique internationally comparable information on the numeracy skills of teachers and STEM professionals as a proxy for the prestige and social status of teaching in different countries.

3 DATA, MEASURES, AND METHODS

3.1 Data

Two sources of data for 29 countries were used: (1) the 2015 edition of Programme for International Student Assessment (PISA) and (2) the first cycle of the OECD's Survey of Adult Skills, Programme for International Assessment of Adult Competencies (PIAAC).[1] We have used PISA data to identify the number and the background characteristics of students who expect to work as teachers. We have used PIAAC data to compare salaries of teachers and STEM professionals; also, to compare numeracy skills of teachers and STEM professionals.

PISA is a triennial large-scale international survey that measures the knowledge and skills of representative samples of 15-year-old students in more than 60 education systems worldwide. PISA assesses performance in reading, mathematics and science.[2] Several large-scale international assessments collect information about student performance and background characteristics. The latest edition of PISA is unique in that it included information on the occupational expectations of students.

PIAAC is a large-scale international assessment covering the non-institutionalised adult population, aged 16-65 years, residing in the country at the time of data collection, irrespective of nationality, citizenship or language status. The survey was administered in the official language, or languages, of each participating country. Some countries gave respondents the possibility of participating in one of the widely spoken minority languages. PIAAC was conducted in 24 countries between 2011 and 2012. Additional eight countries (Chile, Greece, Israel, Lithuania, New Zealand, Singapore, Slovenia and Turkey) administered the same PIAAC assessment in 2015.[3] The survey has two main components: (1) a background questionnaire and (2) an assessment of literacy, numeracy and problem solving in a technology-rich environment.

3.2 Measures

The PISA 2015 questionnaires included the following open-ended question: "What kind of job do you expect to have when you are about 30 years old?" Student responses were coded and classified using the International Standard Classification of Occupations (ISCO-08). We derived a dichotomous variable, indicating if students reported expecting to work as teachers in general, or specifically as primary, secondary, or special education teachers. Students who expected to work as college, university, higher education, pre-primary teachers, or pre-primary or primary associate teachers were excluded from analyses because of the different qualifications required to access these professions. Whilst it would have been interesting to develop and compare measures of students' expectations to work as a teacher in a science field versus other fields, students did not report the specific subject they want to teach in the future. Students were classified as expecting to work as STEM professionals if they indicated in the same open-ended question that they expected to work as science or engineering professionals.[4]

The independent variables of interest were country-level indicators for teacher salaries and teacher numeracy skills; variables were calculated using data from PIAAC. We used individual-level information available in the PIAAC restricted data file on monthly earnings excluding bonuses for wage and salary earners, in purchasing power parity (PPP) (US $ equivalent). We developed a country-level indicator that represents the ratio of the average earnings reported by teachers and STEM professionals. We used the same ISCO-08 classification that was used to identify students' teaching career expectations in PISA to identify teachers in PIAAC. We used information contained in PIAAC on the numeracy skills of individuals to develop a country-level indicator of numeracy skills. We followed the PIAAC standards (OECD, 2013) for calculating a country-level indicator that represents the ratio of the average numeracy skills obtained by teachers and STEM professionals. The correlation between teacher salaries and teacher numeracy skills was .167. Descriptive statistics of these country-level indicators are presented in Appendix A.

Three country-level variables were used as control variables: (1) teaching hours per year, (2) GDP per capita (in current US dollars), and (3) PISA sample selectivity. Teaching hours per year is a frequently used indicator for measuring the working conditions of teachers in international comparative surveys, such as the "Teaching and Learning International Survey" (TALIS). Reducing teaching hours per year is an established policy lever that can be used by education policymakers to reduce attrition or make the teaching profession more attractive (Han et al., 2018; OECD, 2018). The source of data for this indicator is the OECD PISA report (OECD, 2016b).[5] We used the GDP per capita indicator available through the World Bank Open Data portal (https://data.worldbank.org/). PISA contains representative samples of students between the ages of 15 years and 3 months and 16 years and 2 months who were enrolled in institutions at the level of lower secondary school or above. Results may reflect sample selectivity in the PISA survey to the extent that different numbers of youngsters in this age group have dropped out of school or were still in primary education—groups that may be particularly low-achievers and hold poor occupational prospects. We calculated the PISA sample selectivity using the share of the weighted number of PISA participating students in the total population of 15-year-olds.

The background and academic potential of students were examined by gender and by performance in science and mathematics. These characteristics were compared with student expectations to work as teachers and STEM professionals. We focused on science and mathematics because of the relevance of these subjects for STEM occupations. The PISA assessment measures the ability of students to use their knowledge and skills to meet real-life challenges, rather than the extent to which they have mastered a specific school curriculum. The PISA science assessment measures "students' ability to engage in reasoned discourse about science and technology, which requires the competence to explain phenomena scientifically, evaluate and design scientific inquiry, and interpret data and evidence scientifically" (OECD, 2016a, p. 28). The PISA math assessment measures "students' capacity to formulate, employ and interpret mathematics in a variety of contexts" (OECD, 2016a, p. 28).

We use PISA scores as a proxy for the potential cognitive skills of teachers. A large number of studies have shown that most measures for teacher characteristics—education, experience levels, as well as the sources and nature of teacher preparation—are not consistently related to student achievement (see for example, Hanushek, 2003). A few studies have examined the association between teacher cognitive skills and student achievement in the United States (Clotfelter, Ladd, & Vigdor, 2007). Teacher cognitive skills are one of the measures most consistently related to student outcomes (although not all studies identify a positive association) (Hanushek & Rivikin, 2006). Recent data from the OECD PIAAC—which measures skills in pretty much the same way PISA does—reveals that teacher's skills are strongly associated with the reading and mathematics achievement of secondary school students (Hanushek et al., 2018; Meroni et al., 2015). These studies suggest that proficiency in a standardised test that shares many of the key features of PISA is an important determinant of teacher quality. Furthermore, longitudinal studies conducted in countries in which PISA participants were followed over time revealed that fifteen-year-olds with higher PISA scores were more likely to follow and succeed in educational pathways necessary to pursue a career in teaching (Fischbach, Keller, Preckel, & Brunner, 2013; OECD, 2012).

At the level of students, we controlled for gender, immigration background, language spoken at home, family socio-economic status (SES), and whether the parents of the students were employed in the teaching profession. SES was reported in PISA through a composite indicator which reflects the education attainment and occupational placement of students' parents as well as the availability of educational, cultural and economic resources in the students' household, the PISA index of economic, social, and cultural status (ESCS). Immigration background is based on questions asking students if they or their parents were born in the country in which they sat the

PISA test. Students with an immigration background were identified as students who were born abroad or who were children of foreign-born parents. Students participating in PISA were asked to report if the primary language spoken at home was different from the language of instruction. At the school level, we controlled for the socio-economic composition of the school using an indicator of mean SES and school location (urban vs. rural).

3.3 Methods

Answering open-ended questions, such as "What kind of job do you expect to have when you are about 30 years old?", requires more effort from students than answering other questions in the PISA background questionnaire. As a result, the response rate to the PISA career-expectations question was lower than the response rate to questions that can be answered with a simple "yes" or "no" or questions using Likert scales ranging from "strongly agree" to "strongly disagree". An average of approximately 11% of students across OECD countries did not respond to the career-expectations question in 2015. By contrast, only about 2% of students in 2015 did not respond on the number of televisions at home ("How many of these are there at your home? Televisions"); 10% of students did not respond to the question on science clubs ("How often do you do these things? Attend a science club").

All analyses take into account missing values through imputations by chained equation (ICE) (Royston, 2004). The imputation model includes all the variables used in the analyses, as well as socio-demographic variables and student performance in science and mathematics. Imputations were performed for all student-level and school-level characteristics. Fixed effects at country level were included in the imputation models to account for potential country specificities.

Descriptive statistics were calculated by combining estimates from the ten plausible values for proficiency using Rubin's rule and calculating standard errors using balanced repeated replicate (BRR) and students' final weights. This allowed us to correctly account for the nested structure of PISA data (with students nested in schools) and the sampling frame (OECD, 2017b). In Tables 1, 2 and 3, we present differences in background characteristics and academic profiles between students who expect to work as teachers and those who expect to work in STEM professions. We conducted t-tests to assess whether differences in student background and academic profiles between these two groups were statistically significant.

To investigate the association between the teaching career expectations of students, teacher salaries and numeracy skills, we used three-level hierarchical generalised linear models (HGLMs) with students (level 1) nested within schools (level 2) within countries (level 3). Because the dependent variable is binary, we employed HGLMs in which the level 1 sampling model is a Bernoulli distribution (Raudenbush & Bryk, 2002). The country weight factor for normalised weights, SENWT (senate weight), was used to ensure that each country contributes equally to the analysis (OECD, 2017b). We used HLM version 7. The model specification is given below.

Level 1 (Student)

$$\eta_{ijk} = \log[\varphi_{ijk}/(1-\varphi_{ijk})] = \pi_{0jk} + \pi_{1jk}a_{1ijk} + \pi_{2jk}a_{2ijk} + \cdots + \pi_{Pjk}a_{Pijk}$$

where

φ_{ijk} is the probability that a student *i* in school *j* in country *k* expects to have a teaching-related occupation around age 30; and

η_{ijk} is the log odds that a student *i* in school *j* in country *k* expects to have a teaching-related occupation around age 30.

Level 2 (School)

$$\pi_{pjk} = \beta_{p0k} + \sum_{q=1}^{Q_o} \beta_{pqk} X_{qjk} + r_{pjk}$$

Level 3 (Country)

$$\beta_{pqk} = \gamma_{pq0} + \sum_{s=1}^{Spq} \gamma_{pqs} W_{sk} + u_{pqk}$$

Hierarchical models allow us to understand whether relationships between variables at the individual level differ depending on country-level variables through cross-level interaction effects. For example, the cross-level interaction between gender and teacher salaries allows us to assess the extent to which young men are more likely than young women to expect to work as teachers in countries where teacher salaries are comparatively higher. Given the policy discourse on the importance of ensuring that teachers come from the top tertile of the science and mathematics performance distributions (Auguste et al., 2010; Barber & Mourshed, 2007), we employed two different strategies to identify if teacher salaries and relative numeracy skills are differently associated with the teaching expectations of high-, middle- and low- performing students: (a) we modelled interaction effects between the teacher salary and the skills indicators and performance; and (b) we ran our analysis separately for three groups defined according to students' performance levels (top-, middle- and bottom-tertiles of the PISA science and math performance distributions). Country-level continuous covariates, teacher salary and numeracy skill indicators were standardised and grand-mean centred in HGLM analyses.

4 RESULTS

4.1 Background characteristics of students who expect to work as teachers

Table 1 displays, for each country, gender differences in the percentage of students who expected to work as teachers and the percentage of students who expected to work as STEM professionals. In a majority of countries, young men were less likely than young women to expect to work as teachers, although the size of this gap differs across countries. Gender differences in STEM occupational expectations vary to an even greater extent. In seven countries, young men were more likely than young women to expect to work in STEM fields, whilst in twelve countries young women were more likely than young men to expect to work in STEM fields. In ten countries, there were no gender differences in STEM career expectations.

[Table 1]

Table 2 shows, for each country in our sample, the science performance attained in PISA by students who expect to work as teachers and that of students who expect to work in STEM professions. For ten countries, students who expected to work as teachers obtained similar science scores compared to those who expected to work as STEM professionals. In nineteen countries, students who expected to work as teachers demonstrated lower science scores than students who expected to work as STEM professionals. In these nineteen countries, students who expected to work as teachers scored between 18 and 56 points lower than those who expected to work as STEM professionals. Table 3 reports similar results using mathematics achievement instead of science achievement. As was the case for gender gaps in teaching career expectations, the differences in the science and mathematics achievement of students who expect to work as teachers and those who expect to work in STEM professions differ greatly across countries.

[Table 2]
[Table 3]

4.2 Teacher salaries, numeracy skills, and teaching career expectations

Next, we compare country-level differences in salaries and numeracy skills of teachers and STEM professionals. Specifically, the extent to which these factors explain the intentions of students to pursue a career in teaching. Table 4 shows results of a series of three-level HGLMs containing a set of student-level, school-level and country-level variables to control for potential compositional differences. All models control for: teaching hours per year; GDP per capita; PISA sample selectivity; the PISA ESCS index (a proxy of family SES); parents in the teaching profession; immigration status; language spoken at home; location of school; and school mean ESCS. Due to a very strong correlation between science and mathematics scores (on average $\Upsilon = .86$), we present models that are based on individual students' science performance. Results that consider the mathematics performance of individuals are very consistent.

Models 1a, 1b and 1c in Table 4 are the base models in which we included (a) only the teacher salary indicator, (b) only the numeracy skill indicator, and (c) both teacher salary and numeracy skill indicators. These models allow us to examine the role salaries and the numeracy skills of current teachers relative to STEM professional play in shaping the percentage of students in a country who expect to work as teachers. Next, in Model 2a, we added the interaction between gender and salary. In Model 2b, we added the interaction between gender and numeracy skills. In Model 2c, we added the interaction between gender and salary as well as gender and numeracy skills. These models allow us to examine the extent to which teacher salaries and numeracy skills explain the gender gap in the teaching career expectations of students. Finally, in Model 3a, we added the interaction between science scores and teacher salaries. In Model 3b, we added the interaction between science scores and numeracy skills. In Model 3c, we added interactions between science scores and salaries as well as science scores and numeracy skills. These results allowed us to examine the extent to which teacher salaries and numeracy skills were associated with the expectations of high- and low-achieving students' teaching career expectations. Due to the limited sample size at Level 3 (N=29), we have not included interaction terms between gender and Level 3 indicators and between science scores and Level 3 indicators simultaneously.

[Table 4]

Results in Model 1a and 1c indicate that in countries where teacher salaries were comparatively higher, students were more likely to expect to work as teachers. More specifically, as shown in Model 1a, a one standard deviation increase in the index of teacher salaries relative to the salaries of STEM professionals is associated with a 32% increase in the odds that students expect to work as teachers ($\beta = .281$, odds ratio = 1.324, $p \leq .10$) . Model 1b shows the positive association between the teacher numeracy skills relative to the numeracy skills of STEM professionals and students' teaching career expectations. As shown in Model 1b, a one standard deviation increase in relative numeracy skills is associated with a 46% increase in the odds that students will report expecting to work as teachers ($\beta = .380$, odds ratio = 1.462, $p \leq .001$).

The next step in our analysis involved testing if young men and young women respond differently to salary incentives and to differences in the status of the teaching profession relative to the status enjoyed by STEM professionals. Results in Models 2a support the hypothesis that comparatively higher teacher salaries are associated with smaller gender gaps in teaching career expectations. Estimates presented in Model 2a indicate that in countries where teacher salaries are higher, boys and girls are more likely to expect to work as teachers. However, girls appear to be less sensitive to teacher salary levels than boys, leading to more gender-balanced teaching career expectations in countries with comparatively higher teacher salaries.

Results in Model 2b indicate that in countries where teachers have higher numeracy skills compared to the numeracy skills of STEM professionals, more young men and young women are likely to expect to work as teachers. However, young men appear to be more sensitive to teacher numeracy skill levels than young women, leading to more gender-balanced teaching career expectations in countries with comparatively higher teacher numeracy skills levels.

Finally, results in Models 3a, 3b and 3c are illustrated in Table 4. These results reveal that the positive associations between relative teacher salaries, relative numeracy skills, and students' teaching career expectations differ across students of different science abilities. Results in Models 3a and 3c are consistent with the hypothesis that comparatively higher teacher salaries are less strongly associated with expectations of high-ability students in science to work as teachers than with expectations of low-ability students in science. While teacher salaries are positively associated with students' expectations to work as teachers across science performance levels, high-achieving students in science seem to be less sensitive to teacher salary levels than low-achieving students in science.

Results in Models 3b and 3c are also consistent with the hypothesis that high-ability students in science are more likely to expect to work as teachers in countries where current teachers have higher numeracy skills relative to STEM professionals. Results in Model 3b and 3c indicate that the numeracy skills of current teachers are positively associated with students' teaching career expectations overall; the association is stronger the more proficient students in science are.

To check the robustness of findings, we replicated the models presented in Table 4 using a mathematics performance indicator. Results indicate that estimates were very consistent across science and mathematics performance.

4.3 Teacher salaries, numeracy skills, and teaching career expectations, by science performance tertile levels

To identify non-linearities in the strength of the relationships between teacher salaries and teaching career expectations and teacher numeracy skills and teaching career expectations, we ran our models on three subsamples defined by tertiles of science ability. Although in the text we discuss estimates resulting from science performance tertiles, results were very similar when we analysed mathematics performance.

[Table 5]

Results of Panels *a* and *c* in Table 5 reveal that the positive association between teacher salaries and teaching career expectations was stronger among low- and middle-performing students in science than high-performing students in science. Among low-performing students (students in the bottom tertile of the country-specific science performance distribution), the teacher salary coefficient ranged between .295 and .299. This suggests that a one standard deviation increase in the indicator of relative teacher salaries is associated with an increase of between 34% and 35% in the odds that low-ability students in science expect to work as teachers. Among middle-performing students in science, the teacher salary coefficient ranged between .292 and .320. This suggests that a one standard deviation increase in the indicator of relative teacher salaries was associated with an increase of between 34% and 38% in the odds that students expect to work as teachers. However, among top-performing students in science the teacher salary coefficient ranged between .189 and .221. This indicates that a one standard deviation increase in the indicator of teacher salaries was associated with an increase of between 21% and 25% in the odds that top-performing students expect to work as teachers.

Panels *b* and *c* in Table 5 highlight that the positive association between teacher numeracy skills and teaching career expectations differed across science performance levels. The positive association described in Table 4 was strong and statistically significant only among the top-performing tertile of students in science. The positive association was not statistically significant and was quantitatively close to zero among students in the bottom-tertile of the science performance distribution. Among top-performing students in science, the teacher numeracy skills coefficient ranged between .284 and .302. This indicates that a one standard deviation increase in the indicator of relative teacher numeracy skills was associated with an increase of between 33% and 35% in the odds that high-ability students expected to work as teachers. Among middle-performing students in science, the teacher numeracy skills coefficients were positive, but not statistically significant at conventional levels. On the other hand, among low-performing students in science, the teacher numeracy skill coefficients were close to zero and not statistically significant. These findings suggest that there is no relationship between teacher numeracy skills and the likelihood that low-performing students in science expect to work as teachers.

5 DISCUSSION

The study we have presented builds on expectancy-value theory and the FIT-Choice model. We explored if students with high-abilities in science and mathematics, and young men, were more likely to express an interest in entering K-12 teaching in countries where teacher salaries and numeracy skills were high in comparison to salaries and skills among STEM professionals. Previous studies have focused on teacher salaries and working conditions in general (Han et al., 2018; Park & Byun, 2015). We focused specifically on the conditions of the teaching profession compared to STEM professions because STEM professions are among the careers that academically strong students in mathematics and science choose to pursue (OECD, 2016a).

Our results reveal that in a majority of countries, students who expect to work as teachers have lower performance scores in mathematics and science than those who expect to work in a STEM profession. In addition, gender imbalances are more accentuated in teaching career expectations than STEM career expectations. These findings indicate that unless education systems take active steps, it will not only be difficult to recruit highly qualified individuals into teaching, but also that the gender gap in the teaching profession will continue to grow in the future.

We have sought to identify some of the factors that can attract high-ability students in mathematics and science, and young men, into the teaching profession. We examined if teacher salaries—when compared to the salaries of STEM professionals—act as an economic incentive in the decision to become a teacher. Consistent with prior research (Han et al., 2018), our results reveal that competitive teacher salaries might promote teaching career expectations among students overall. However, competitive teacher salaries appear to motivate lower-achievers in mathematics and science, rather than higher-achievers in mathematics and science, to pursue a career in teaching. Our results suggest that extrinsic economic incentives alone will not enable education systems to expand the pool of high-skilled students in mathematics and science who will consider a career in teaching.

Competitive teacher salaries were associated with smaller gender gaps in teaching career expectations. This finding differs from previous research examining the effect of teacher salaries on the gender gap in the teaching career expectations of students (Park & Byun, 2015). Park and Buyn found a positive association between teacher salaries and teaching career expectations across both genders and, therefore, that teacher salaries did not explain gender gaps in teaching career expectations across 23 OECD countries that participated in PISA 2006.

The association between teacher salaries and teaching career expectations appears to differ across performance levels in science and mathematics. Crucially, our study revealed that other factors are important for shaping teaching career expectations among high-achieving students in mathematics and science. We found that in countries where teachers enjoy comparatively higher status and prestige, more young men and high-ability students in science and mathematics—when compared with young women and low-ability students—are likely to expect to work as teachers.

Some researchers have suggested that making teacher salaries competitive with other professions is important for attracting high-achieving students into the teaching profession and for improving teacher quality (e.g. Dolton & Marcenaro-Gutierrez, 2011). In the United States, for example, lower secondary teacher salaries are 66% of those earnt by other tertiary educated full-time employed persons aged 25-64 years (OECD, 2017a). Moreover, the average salary (one year after graduation) for individuals who graduated from college in 2000 and who became teachers was almost half of the salary obtained by their classmates who started to work in computer programming (Ingersoll & Merrill, 2011). Our study suggests that policymakers should acknowledge that teacher pay incentives *alone* might not be effective in attracting high-achieving students in mathematics and science into the teaching profession.

Our study has the limitations of all cross-sectional studies: results presented are based on a single wave of cross-sectional and cross-national data and therefore do not imply causal relationships. Future research could build on the evidence presented in this study to establish causality between teacher salaries, social status of the teaching profession, and teaching career expectations. One possible way to make a causal inference is to analyse repeated cross-sectional international large-scale assessments data for changes within countries over time (Hanushek, Link, & Woessmann, 2013). In order to make causal inferences with cross-sectional data (such as the PISA data used in this study) at least three time points are needed (Hanushek et al., 2013). The PISA 2018 collection of teaching career expectations of students provides data that can be examined in further research for changes in the influence of salaries and the distribution of academic performance among students who expect to become teachers.

In addition, it is difficult to test the validity of the outcome measure (teaching career expectation) in the current study because we conducted a secondary analysis of data from a large-scale international assessment. These data have the advantage of being highly generalizable thanks to the large, representative samples involved. However, they suffer from a number of limitations; most importantly, the fact that the age at which career decisions are made may differ across countries and, with it, the extent to which expectations are associated with entry in the teaching profession. Therefore, the findings from this study should be interpreted with caution. Prior studies show that students' career expectations can change after they enter post-secondary institutions (Mau & Mau, 2006). In some countries (e.g. Japan and Korea) teacher education is studied at the undergraduate level, while in other countries (e.g. United States) teacher education is studied at the graduate level (Wang, Coleman, Coley, & Phelphs, 2003). Depending on the structure of teacher training programmes and how flexible educational systems are, the moment at which students have to make decisions (or are still able to make decisions) about prospective careers differs. While cross-country evidence suggests that the career expectations of secondary school students have predictive validity (which we reviewed in this work), future studies could attempt to make use of longitudinal studies to determine the extent to which the predictive validity of students' reports differs across countries and professions. Like PISA, several individual-country secondary longitudinal studies programs (e.g. Educational Longitudinal Study of 2002 and High School Longitudinal Study of 2009 in the United States, and Longitudinal Study of Australian Youth in Australia) use an open-ended question for measuring students' career expectations.

In the study on which we report in this article, we used mathematics and science scores from the PISA study as a proxy for the quality of the future teaching workforce. Cross-national evidence suggests that teacher skills measured in a test that is very similar to PISA, are positively associated with student performance (Hanushek et al., 2018; Meroni et al., 2015). Our study focused only on one dimension of future teacher characteristics. Since cognitive skills are just one of the many factors that determine teacher quality, future studies should examine cognitive skills in conjunction with other factors and how strongly they are related with the career expectations and individual decisions to enter the teaching profession.

In sum, our study has contributed to the growing knowledge base on how to attract high-ability individuals, in particular in mathematics and science, and how to motivate men to pursue a career in teaching. Our study focused on factors that influence the *comparative* attractiveness of the teaching profession. Our results suggest that a policy targeted only on the improvement of financial rewards in teaching is limited in attracting high-ability math and science candidates, as well as men, into the teaching profession. Finland is an important case to study for policymakers interested in promoting the recruitment of high-ability students to the teaching profession. In Finland, the social status of the teaching profession was improved thanks to concerted and consistent reforms (OECD, 2010), which involved a coherent package of policies designed to improve the status, prestige and professionalization of the teaching profession.

Data availability statement

Authors elect to not to share data.

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Table 1. Background characteristics of students who expect to work as teachers and those who expect to work in STEM professions

	Teaching Profession							STEM Professions						
	Men		Women		Diff (W-M)			Men		Women		Diff (W-M)		
	%	*SE*	%	*SE*	%		*SE*	%	*SE*	%	*SE*	%		*SE*
Australia	2.87	(0.21)	8.62	(0.46)	5.75	*	(0.47)	32.17	(0.81)	29.79	(0.73)	-2.38	*	(0.94)
Austria	2.30	(0.31)	8.19	(0.69)	5.89	*	(0.73)	31.08	(1.83)	21.28	(1.14)	-9.80	*	(2.06)
Estonia	0.68	(0.21)	2.13	(0.30)	1.46	*	(0.37)	33.36	(1.07)	23.08	(0.84)	-10.28	*	(1.32)
France	2.11	(0.30)	5.44	(0.43)	3.33	*	(0.51)	26.21	(1.01)	20.62	(0.83)	-5.59	*	(1.25)
Germany	1.91	(0.33)	5.24	(0.42)	3.33	*	(0.50)	22.03	(1.01)	15.35	(0.70)	-6.68	*	(1.18)
Singapore	3.49	(0.41)	5.35	(0.46)	1.85	*	(0.66)	33.08	(1.06)	24.75	(0.90)	-8.32	*	(1.41)
Turkey	3.86	(0.44)	7.37	(0.60)	3.51	*	(0.63)	36.14	(1.78)	25.72	(1.26)	-10.43	*	(1.60)
Czech Republic	1.48	(0.22)	5.20	(0.65)	3.72	*	(0.67)	16.57	(0.80)	15.12	(0.79)	-1.45		(1.00)
Greece	3.85	(0.51)	8.05	(0.63)	4.19	*	(0.69)	25.36	(1.24)	25.11	(1.15)	-0.25		(1.53)
Ireland	6.74	(0.60)	16.92	(0.82)	10.18	*	(0.94)	28.42	(0.95)	27.05	(1.04)	-1.37		(1.32)
Italy	1.13	(0.22)	5.22	(0.39)	4.09	*	(0.44)	23.85	(1.06)	21.78	(1.28)	-2.08		(1.31)
Korea	9.18	(0.56)	12.33	(0.73)	3.15	*	(0.90)	18.80	(0.98)	17.46	(1.04)	-1.34		(1.43)
Netherlands	3.55	(0.50)	6.25	(0.45)	2.70	*	(0.66)	16.72	(0.88)	15.23	(0.79)	-1.50		(1.06)
Russian Federation	0.61	(0.18)	4.53	(0.62)	3.92	*	(0.67)	25.76	(0.98)	26.01	(1.02)	0.25		(1.34)
Spain	4.14	(0.38)	7.13	(0.51)	3.00	*	(0.66)	30.51	(0.99)	28.75	(0.89)	-1.75		(1.23)
Sweden	1.11	(0.25)	1.96	(0.27)	0.85	*	(0.35)	18.26	(0.92)	18.96	(0.91)	0.69		(1.17)
Canada	0.37	(0.11)	1.71	(0.21)	1.33	*	(1.33)	39.63	(0.93)	44.01	(0.89)	4.39	*	(1.20)
Chile	1.70	(0.28)	3.78	(0.37)	2.08	*	(0.42)	38.40	(1.11)	42.74	(1.23)	4.34	*	(1.71)
Denmark	0.71	(0.17)	1.64	(0.28)	0.94	*	(0.31)	12.68	(0.82)	19.36	(0.79)	6.68	*	(1.04)
Finland	2.84	(0.34)	6.50	(0.51)	3.66	*	(0.57)	16.02	(0.71)	19.69	(0.84)	3.67	*	(0.96)
Israel	3.01	(0.57)	6.72	(0.58)	3.70	*	(0.68)	27.87	(0.94)	31.62	(0.97)	3.74	*	(1.28)
Lithuania	0.87	(0.17)	2.66	(0.37)	1.79	*	(0.39)	24.21	(1.03)	27.32	(0.75)	3.12	*	(1.18)
New Zealand	1.19	(0.24)	4.85	(0.50)	3.66	*	(0.55)	24.30	(0.92)	29.47	(1.15)	5.17	*	(1.28)
Norway	1.80	(0.28)	4.71	(0.58)	2.91	*	(0.56)	23.25	(1.01)	29.71	(0.94)	6.47	*	(1.29)
Poland	1.19	(0.24)	3.72	(0.46)	2.53	*	(2.53)	15.09	(0.91)	28.11	(1.25)	13.02	*	(1.30)
Slovak Republic	0.88	(0.16)	5.05	(0.82)	4.17	*	(0.79)	15.54	(0.83)	20.00	(1.13)	4.46	*	(1.23)
Slovenia	2.16	(0.33)	6.78	(0.53)	4.61	*	(0.61)	22.94	(0.85)	25.62	(1.04)	2.68	*	(1.32)

United States	1.42	(0.23)	4.22	(0.45)	2.80	*	(0.54)	34.57	(1.10)	43.59	(1.11)	9.03	*	(1.47)
Japan	7.36	(0.59)	6.14	(0.51)	-1.22		(0.80)	20.34	(1.10)	19.34	(0.85)	-1.00		(1.18)

SE = standard error; *$p \leq .05$

Source: Table constructed by authors using data from PISA 2015

Table 2. Science performance of students who expect to work as teachers

	Students expecting to work as teachers (TP)				Students expecting to work in STEM professions				Difference (STEM-TP)		
	%	Standard Error	Mean	Standard Error	%	Standard Error	Mean	Standard Error	Score		Standard Error
Austria	5.24	(0.41)	523.34	(6.14)	26.18	(1.14)	528.15	(3.85)	4.81		(6.67)
Chile	2.74	(0.25)	451.51	(9.05)	40.56	(0.81)	467.65	(3.42)	16.14		(8.33)
Denmark	1.17	(0.17)	529.42	(12.66)	15.99	(0.61)	529.43	(3.65)	0.01		(12.46)
Estonia	1.41	(0.18)	571.17	(11.61)	28.18	(0.70)	562.97	(3.04)	-8.20		(11.81)
Germany	3.60	(0.29)	560.86	(6.63)	18.65	(0.63)	565.93	(4.19)	5.06		(7.31)
Japan	6.75	(0.38)	566.98	(5.13)	19.84	(0.79)	566.93	(4.36)	-0.05		(5.22)
Norway	3.25	(0.35)	517.48	(8.62)	26.46	(0.74)	527.25	(3.20)	9.78		(8.66)
Slovenia	4.42	(0.32)	550.87	(5.55)	24.25	(0.68)	554.78	(3.29)	3.92		(6.36)
Sweden	1.53	(0.19)	509.63	(15.60)	18.61	(0.70)	533.15	(5.20)	23.52		(15.17)
United States	2.84	(0.24)	516.49	(7.70)	39.14	(0.83)	516.60	(3.74)	0.11		(7.90)
Czech Republic	3.31	(0.36)	531.99	(7.81)	15.86	(0.62)	553.26	(3.40)	21.27	*	(7.99)
Korea	10.69	(0.47)	541.88	(4.07)	18.16	(0.72)	559.38	(4.90)	17.50	*	(5.63)
New Zealand	3.05	(0.29)	527.28	(9.12)	26.92	(0.84)	551.51	(3.68)	24.23	*	(8.92)
Poland	2.44	(0.27)	517.69	(10.32)	21.50	(0.89)	542.66	(3.26)	24.97	*	(10.21)
Russian Federation	2.65	(0.34)	484.21	(7.64)	25.89	(0.74)	508.46	(3.78)	24.25	*	(9.24)
Singapore	4.39	(0.29)	562.12	(6.51)	29.04	(0.68)	581.82	(2.68)	19.70	*	(7.17)
Australia	5.75	(0.28)	510.19	(4.47)	30.98	(0.61)	546.96	(2.49)	36.76	*	(4.78)
Canada	1.06	(0.12)	525.09	(9.15)	41.87	(0.69)	554.66	(2.29)	29.58	*	(8.53)
Finland	4.62	(0.33)	554.92	(5.51)	17.80	(0.61)	580.38	(3.51)	25.46	*	(6.74)
France	3.80	(0.28)	514.36	(7.15)	23.37	(0.69)	555.07	(2.92)	40.71	*	(7.71)
Greece	5.93	(0.47)	454.18	(5.09)	25.23	(0.92)	496.19	(4.96)	42.01	*	(6.76)
Ireland	11.76	(0.55)	498.42	(3.67)	27.74	(0.75)	532.51	(3.16)	34.09	*	(3.91)
Israel	4.91	(0.47)	428.25	(8.83)	29.79	(0.71)	484.15	(4.24)	55.90	*	(8.95)
Italy	3.23	(0.25)	476.68	(8.63)	22.79	(0.99)	520.74	(4.39)	44.06	*	(9.07)
Lithuania	1.76	(0.21)	472.93	(8.21)	25.76	(0.68)	515.40	(3.20)	42.47	*	(9.37)
Netherlands	4.93	(0.34)	506.68	(6.48)	15.96	(0.65)	562.44	(4.31)	55.76	*	(7.74)

Slovak Republic	2.91	(0.45)	472.33	(6.02)	17.71	(0.78)	520.80	(3.40)	48.47	*	(7.37)
Spain	5.65	(0.30)	482.70	(4.93)	29.62	(0.71)	530.32	(2.36)	47.62	*	(5.52)
Turkey	5.64	(0.43)	404.90	(6.02)	30.85	(1.36)	451.52	(4.85)	46.63	*	(7.09)

*$p \leq .05$

Source: Table constructed by authors using data from PISA 2015

Table 3. Mathematics performance of students who expect to work as teachers

	Students expecting to work as teachers (TP)		Students expecting to work in STEM professions		Difference (STEM-TP)		
	mean	Standard Error	mean	Standard Error	Score		Standard Error
Austria	520.03	(5.73)	527.06	(4.77)	7.02		(6.58)
Chile	426.52	(8.58)	441.53	(3.49)	15.01		(7.89)
Czech Republic	537.22	(7.05)	547.13	(3.48)	9.91		(7.48)
Denmark	524.79	(11.82)	531.98	(3.13)	7.18		(11.54)
Estonia	544.93	(10.74)	544.98	(3.31)	0.05		(10.94)
Germany	548.04	(6.70)	553.83	(4.07)	5.79		(7.47)
Japan	563.84	(5.77)	560.92	(4.19)	-2.92		(5.69)
Norway	519.40	(6.98)	526.55	(3.25)	7.15		(6.83)
Poland	520.67	(11.29)	539.97	(3.61)	19.30		(11.23)
Russian Federation	498.04	(9.19)	515.64	(4.13)	17.60		(9.05)
Singapore	572.74	(5.85)	584.97	(2.97)	12.23		(6.25)
Slovenia	545.15	(5.74)	545.43	(2.75)	0.28		(6.55)
Sweden	503.67	(12.75)	527.10	(4.62)	23.43		(12.74)
United States	486.24	(7.45)	487.66	(4.05)	1.43		(6.97)
Korea	555.00	(4.84)	567.88	(5.33)	12.88	*	(5.58)
New Zealand	501.51	(7.49)	525.05	(3.40)	23.54	*	(7.51)
Australia	492.63	(4.45)	527.20	(2.32)	34.57	*	(4.37)
Canada	515.16	(9.99)	542.26	(2.34)	27.10	*	(9.39)
Finland	527.63	(4.22)	553.07	(3.31)	25.44	*	(5.19)
France	510.49	(6.13)	548.49	(3.06)	37.99	*	(6.73)
Greece	451.61	(5.34)	493.28	(4.83)	41.67	*	(6.46)
Ireland	503.23	(3.66)	526.61	(2.76)	23.38	*	(4.13)
Israel	427.97	(10.12)	480.55	(4.32)	52.58	*	(10.37)
Italy	477.70	(9.62)	532.01	(4.44)	54.31	*	(9.97)
Lithuania	475.91	(10.16)	514.82	(3.14)	38.91	*	(10.68)

Netherlands	510.55	(6.33)	561.00	(3.82)	50.45	*	(7.44)
Slovak Republic	481.82	(8.53)	527.86	(4.70)	46.04	*	(9.42)
Spain	475.79	(5.16)	519.01	(2.57)	43.21	*	(5.64)
Turkey	398.42	(6.66)	447.81	(5.17)	49.39	*	(7.36)

*$p \leq .05$

Source: Table constructed by authors using data from PISA 2015

Table 4. Results of Hierarchical Bernoulli Logit Models to Explain Variation in Expectations for the Teaching Profession

	Model 1a		Model 1b		Model 1c		Model 2a		Model 2b		Model 2c	
Girl	0.854	***	0.827	***	0.827	***	0.828	***	0.834	***	0.839	***
	(0.030)		(0.068)		(0.069)		(0.074)		(0.059)		(0.064)	
Science score	0.067	***	0.039		0.064	*	0.067	*	0.039		0.066	*
	(0.018)		(0.036)		(0.029)		(0.029)		(0.036)		(0.030)	
Relative teacher salary	0.281	Ϯ			0.253	*	0.355	**			0.304	*
	(0.142)				(0.109)		(0.126)				(0.110)	
Relative numeracy skill			0.380	***	0.147				0.475	***	0.200	
			(0.095)		(0.139)				(0.125)		(0.170)	
Girl * Teacher salary							-0.083	Ϯ			-0.055	
							(0.045)				(0.045)	
Girl * Numeracy skill									-0.156	Ϯ	-0.083	
									(0.079)		(0.091)	
Science * Teacher salary												
Science * Numeracy skill												
Observations (students)	203,292		203,292		203,292		203,292		203,292		203,292	
Clustering units (schools)	7,800		7,800		7,800		7,800		7,800		7,800	
Clustering units (countries)	29		29		29		29		29		29	

Source: Table constructed by authors using data from PISA 2015

Table 4 continued

	Model 3a		Model 3b		Model 3c	
Girl	0.821	***	0.829	***	0.831	***
	(0.078)		(0.070)		(0.071)	
Science score	0.065	*	0.047		0.057	†
	(0.031)		(0.029)		(0.057)	
Relative teacher salary	0.170	*			0.264	*
	(0.078)				(0.097)	
Relative numeracy skill			0.185	†	0.149	
			(0.103)		(0.112)	
Girl * Teacher salary						
Girl * Numeracy skill						
Science * Teacher salary	-0.043	†			-0.060	*
	(0.023)				(0.022)	
Science * Numeracy skill			0.115	***	0.133	***
			(0.031)		(0.037)	
Observations (students)	203,292		203,292		203,292	
Clustering units (schools)	7,800		7,800		7,800	
Clustering units (countries)	29		29		29	

Source: Table constructed by authors using data from PISA 2015

Note. All regression control for PISA ESCS, parents in the teaching profession, immigration status, language spoken at home, school urbanity, school mean ESCS, teaching hours per year, Log of GDP per capita and PISA sample selectivity. Population average models with robust standard errors (in parentheses).

***$p \leq .001$, **$p \leq .01$, *$p \leq .05$, †$p \leq .10$

Table 5. Results of Hierarchical Bernoulli Logit Models to Explain Variation in Expectations for the Teaching Profession, by Science Performance Levels

	Top-tertile				Middle-tertile				Bottom-tertile			
	β		*OR*	*SE*	*β*		*OR*	*SE*	*β*		*OR*	*SE*
Panel a												
Relative teacher salary	0.221	*	1.248	(0.098)	0.320	**	1.377	(0.135)	0.299	*	1.348	(0.137)
Panel b												
Relative numeracy skills	0.302	**	1.352	(0.091)	0.237	*	1.268	(0.113)	0.035		1.036	(0.158)
Panel c												
Relative teacher salary	0.189	*	1.207	(0.080)	0.292	*	1.338	(0.122)	0.295	*	1.343	(0.133)
Relative numeracy skills	0.284	**	1.328	(0.094)	0.200		1.222	(0.126)	-0.017		0.983	(0.190)

Source: Table constructed by authors using data from PISA 2015

Note. Each column in each panel reports results from one regression. All regression control for gender, PISA ESCS, parents in the teaching profession, immigration status, language spoken at home, school urbanity, School mean ESCS, teaching hours per year, Log of GDP per capita and PISA sample selectivity. Population average models with robust standard errors.

β = coefficient; *SE* = standard error.

***$p \leq .001$, **$p \leq .01$, *$p \leq .05$

Appendix A. Descriptive statistics of country-level variables

	Relative teacher salaries to STEM professions	Relative teacher numeracy skills to STEM professions
Australia	0.81	0.96
Austria	0.84	0.93
Canada	0.86	0.92
Chile	0.64	0.90
Czech Republic	0.72	0.96
Denmark	0.83	0.96
Estonia	0.75	0.92
Finland	0.90	0.95
France	0.99	0.97
Germany	0.94	0.96
Greece	1.64	0.93
Ireland	1.18	0.96
Israel	0.69	0.86
Italy	1.07	0.87
Japan	0.94	1.00
Korea	0.98	0.97
Lithuania	1.13	0.94
Netherland	0.86	0.92
New Zealand	0.80	0.90
Norway	0.70	0.92
Poland	1.18	0.94
Russian Federation	0.77	0.98
Singapore	0.94	0.98
Slovak Republic	0.75	0.95
Slovenia	1.00	0.97
Spain	0.89	0.91

Sweden	0.75	0.90
Turkey	0.98	0.92
USA	0.62	0.94

Source: Table constructed by authors using data from PIAAC

[1] Details about PISA, such as participating countries, purposes of PISA assessments, and PISA test questions, are available on the OECD PISA website: http://www.oecd.org/pisa/. Details about PIAAC are available on the OECD PIAAC website: http://www.oecd.org/skills/piaac/.

[2] In each PISA survey wave three subject domains are tested and one of the three is assessed as the major domain. PISA 2000 and 2009 focused on reading; PISA 2003 and 2012 focused on mathematics; and PISA 2006 and 2015 focused on science.

[3] The survey was also administered in Indonesia in the second round, but only in the city of Jakarta.

[4] Following the classification of STEM professionals adopted in the OECD's PISA analyses, all individuals classified as expecting to work as science or engineering professionals under ISCO-08 major category 21 were included except for Product and Garment Designers (ISCO code 2163) and Graphic and Multimedia Designers (ISCO code 2166). All Health professional under ISCO classification 22 were included, except for Traditional and Complementary Medicine Professionals (ISCO code 223). All Information and Communications Technology Professionals (ISCO major category 25) were included.

[5] In Sweden, the indicator of teaching hours per year is missing. We combined two sources of data to create the estimate of teaching hours per year for Sweden: TALIS 2013 and the TIMSS 2011 Encyclopedia (Mullis et al., 2012). In TALIS 2013, lower secondary teachers in Sweden reported that they work on average 18 hours per week for teaching duties. In Sweden, the school year in primary and lower secondary grades is divided into two semesters and should comprise between 179 and 190 hours (Monday – Friday) (Mullis et al., 2012). Consequently, we estimated that teaching hours per year in Sweden range between 640.8 to 684 hours in Sweden.