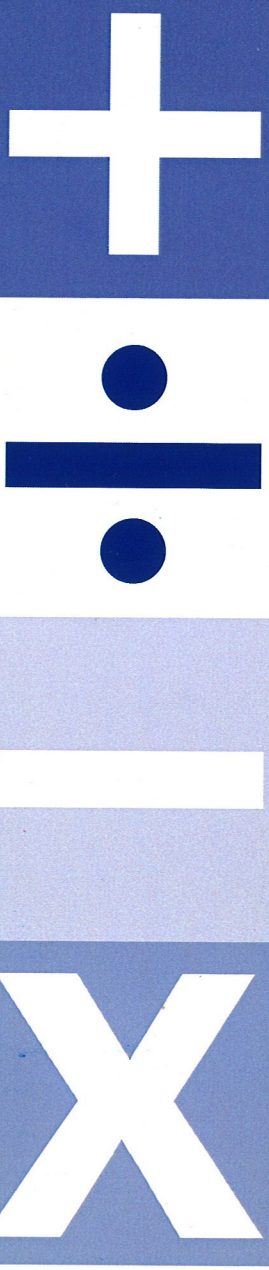
TEDS-M

TEACHER EDUCATION AND DEVELOPMENT STUDY IN MATHEMATICS (TEDS-M)

Do Countries Paying Teachers Higher Relative Salaries Have Higher Student Mathematics Achievement?

Martin Carnoy
Iliana Brodziak
Thomas Luschei
Tara Beteille
Prashant Loyalka



Do Countries Paying Teachers Higher Relative Salaries Have Higher Student Mathematics Achievement?

Martin Carnoy
Iliana Brodziak
Thomas Luschei
Tara Beteille
Prashant Loyalka

Stanford University
School of Education
Carnoy@stanford.edu

TEDS-M

ISBN/EAN: 978-90-79549-05-4

Copies of *Do Countries Paying Teachers Higher Relative Salaries Have Higher Student Mathematics Achievement?* can be obtained from:

The IEA Secretariat
Herengracht 487
1017 BT Amsterdam, the Netherlands
Telephone: +31 20 625 3625
Fax: + 31 20 420 7136
Email: Department@IEA.nl
Website: www.iea.nl

This report was prepared for the TEDS-M project under the auspices of the International Association for the Evaluation of Educational Achievement (IEA) and supported by a grant from the National Science Foundation (NSF) and funding from IEA. The research for seven of the countries included in this report (Bulgaria, Chinese Taipei, England, Germany, Korea, Mexico, and the United States) was prepared under an earlier NSF grant and as part of a still ongoing project at Michigan State University (P-TEDS). Those seven countries were the subject of an earlier paper, "How Much Would It Cost to Attract Individuals with More Mathematics Knowledge into Middle School (Lower Secondary) Teaching? A Seven-Country Comparison" (Michigan State University: mimeo, January 2006). We would like to thank MSU, IEA, and the NSF for all their support.

A Note on the Authors

Martin Carnoy is Vida Jacks Professor of Education and Economics, Stanford University. Tara Beteille is a post-doctoral student at the School of Education, Stanford. Prashant Loyalka is an assistant professor at Peking University's China Institute for Education Finance Research. Iliana Brodziak is a researcher at the American Institutes for Research in Palo Alto. Thomas Luschei is Assistant Professor of Education at Florida State University.

Acknowledgments

This study would not have been possible without the help of many people in the countries we studied.

Some of these, such as Thabo Mzwinila, from Botswana, Kiril Bankov from Bulgaria, Beatrice Avalos from Chile, Sigrid Blömeke from Germany, Evangeline Golla from the Philippines, Khoon Yoong Wong from Singapore, Jesus Dominguez from Spain, and Fritz Oser from Switzerland, are either part of the P-TEDS or TEDS-M projects or took an active role in helping us get salary data from their countries.

Others provided varied forms of assistance. Claude Thélot and our colleagues at the National Institute of Statistics and Economic Studies (INSEE), France, helped us with the French data, Yue-Ping Chung, Professor at the Chinese University of Hong Kong and a Stanford graduate, conducted the Hong Kong estimates for us, Young-sook Nam (a Stanford graduate) and Seung-bok Kang were instrumental in getting us the Korean data, Zhi Hui Tang helped us obtain the Singapore data, and Kent Chang helped us in Chinese Taipei.

The statistics bureaus in various countries—Australia, Chinese Taipei, Finland, Germany (German Institute for Economic Research (DIW) and Cornell University), Norway, the Philippines, Singapore, Spain, Switzerland, and Thailand—were very cooperative in working with us to obtain accurate data for our estimates. Special thanks to Torbjorn Haegeland and Lars Kirkeboen of the research department of Statistics Norway for undertaking the complex estimates for Norway.

We also appreciate the comments from those representatives of the International Association for the Evaluation of Educational Achievement (IEA) General Assembly who were able to provide feedback on the country studies.

We are, of course, indebted to William Schmidt, Maria Teresa Tatto, Barbara Malak, and Hans Wagemaker for their ongoing support of the project.

Table of Contents

List of Tables

List of Figures

PART I

CROSS-COUNTRY ANALYSIS OF TEACHER SALARIES AND STUDENT ACHIEVEMENT

1. Introduction

Educators have long claimed that good teaching is the key to higher student achievement, as well as to other positive student outcomes, such as moral values and tolerance. Economists also have bought into this argument (Clotfelter, Ladd, & Vigdor, 2007; Rivkin, Hanushek, & Kain, 2005; Wright, Horn, & Sanders, 1997). Although not all economists agree that higher salaries are associated with better teaching (see, for example, Hanushek, 2006), there seems to be, even on this matter, a shift in their thinking toward the notion that using monetary incentives to reward good teaching is a means of recruiting better-prepared individuals into teaching (Lavy, 2005). Increasingly, it seems acceptable to argue that teaching quality may be higher in countries that pay teachers more (especially in return for greater competence) than the pay received by competing professionals.

The reverse side of this coin is the common complaint in the literature that a significant proportion of mathematics middle school and secondary teachers are not sufficiently well trained in subject matter to teach higher level arithmetic concepts, introductory algebra, and introductory geometry to seventh and eighth graders (Organisation for Economic Co-operation and Development (OECD), 2003). Yet, some nations are better able than others to supply many more of these "elements" of mathematics knowledge to teachers.

Some countries may "purchase" higher levels of teacher mathematics knowledge because it is inexpensive to do so. The price of attracting more "mathematics- oriented" individuals into teaching may be lower in certain countries than in others because market demand for mathematics-intensive professions is relatively low. Also, even with relatively high demand, the supply of mathematics-oriented professionals in some countries may be high because past investments have created a young labor force well prepared in mathematics, thus making it relatively inexpensive in those countries to train almost any high school graduate to become not only a "good" mathematics professional but also a good mathematics teacher.

Another reason why wages in mathematics-intensive professions may be relatively lower in some countries is that political choices have kept the income distribution somewhat more equal, thus holding down the salaries of highly demanded professions relative to professions such as teaching. In this case, it is easier to attract mathematics-oriented individuals into teaching because they do not have to give up as much monetarily to pursue a teaching career.

Countries such as the United States can therefore find it expensive to match the better mathematics teacher preparation in other countries, mainly because of the higher salaries of university-educated engineers, mathematicians, and scientists compared to university-educated mathematics teachers and mathematics teacher trainers. These high salaries are the result of a small pool of labor with high-level mathematics skills and a very high demand in industry for workers with such skills. Furthermore, countries such as the United States, where student teachers have a comparatively poor high school mathematics background, may find it expensive to train these people to a high level of mathematics competence primarily because they start out so far behind.

These two reasons are difficult to separate, because the more widely that mathematical skills are available in the labor force, the smaller the likely difference in wages between workers in jobs requiring these skills and workers in other professions, such as teaching, where the emphasis is on other skills. Accordingly, if all high school graduates have relatively high mathematics skills, the premium for jobs requiring these skills will not be as great as in economies where mathematics skills are rarer. However, mathematics skills do vary greatly in national student populations (see, for example, Mullis, Martin, Gonzalez, & Chrostowski, 2004, for an analysis of the Trends in International Mathematics and Science Study (TIMSS)).

In nearly all education systems, mathematics teachers are not paid on the basis of their mathematics skills; rather, they, as with all teachers, *are paid as teachers*, usually according to their education and teaching experience, and often by the level of schooling taught. Thus, if teachers as a profession are paid less than scientists and engineers, mathematics teachers will also be paid less. They, then, as a class of professionals, are likely to have lower mathematics skills than engineers, scientists, accountants, and workers in other mathematics-intensive professions who are paid mainly for their mathematics skills. So, even in countries where the average high school graduate is, compared to counterparts in other countries, well trained in mathematics, it is possible that recruiting individuals with adequate mathematics knowledge to become teachers will still be difficult if teachers are paid much less than people in mathematics-intensive professions, and if teachers are paid similarly no matter which subject they teach.

Finally, we observe that some countries facing similar income distributions are willing to pay teachers more relative to non-teaching professionals. We could argue that some parents (or governments) in some countries have a greater preference for high-quality mathematics teaching, where quality is measured by individuals' mathematics knowledge. Even within countries such as the United States, where states are responsible for teacher pay policies, there is considerable variation in average teacher relative pay. States such as Connecticut pay somewhat higher teacher salaries, and states such as California pay teachers somewhat lower salaries. This situation suggests that even when the supply of mathematics-oriented professionals and income distribution are similar, the public sector's willingness to pay teachers' salaries will vary from one political jurisdiction to another.

In this publication, we compare the salaries of primary (Grades 1 to 6 in most countries) and secondary school (usually Grades 7 to 12) teachers with the salaries of people in mathematics-oriented professions, such as engineering, scientific fields, and accounting. Our analysis centers on a number of developed and developing countries. We also look at the relationship between what mathematics teachers are paid and the mathematics scores of Grades 8 and 10 students on mathematics tests associated with the Third International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA).

Because, as we previously noted, teachers who teach mathematics are generally paid on the same scale as other teachers, we use the salaries of teachers as a category to measure the salary of mathematics teachers. We compare the salaries of teachers as a profession with the salaries of personnel in mathematics-oriented professions to secure a measure of how teachers teaching mathematics are paid compared to those in occupations that teachers might enter if they were well trained in mathematics. We hypothesize that students in societies with higher rates of teacher pay score higher on the TIMSS and PISA mathematics tests than do students in societies with lower rates of teacher pay.

Many studies have attempted to explain why students in some countries achieve higher scores on international tests. Many of these studies focus on differences in performance between students of higher and students of lower socioeconomic status (SES) (see, for example, Willms, 2003); others include proxies for teacher quality, usually teacher education, experience, and measures of teacher attitudes (see, for example, Carnoy, Marshall, & Socias, 2003; OECD, 2004b). Some consider opportunity to learn (Carnoy et al., 2003; Schmidt et al., 2002), and some investigate the varying social contexts of schooling in different countries (Carnoy, Gove, & Marshall, 2007).

However, these studies and those done within countries using student performance as an outcome find it difficult to identify the teacher characteristics that contribute to higher student performance. The main reason why seems to be that these teacher characteristics are either not well identified or relate strongly to student SES (better-educated teachers are likely to be teaching in schools containing students primarily from higher SES backgrounds, for example).

Our study focuses on a variable that has not traditionally been part of the analyses of student performance across countries, namely teacher relative salary as a proxy for teacher quality. This variable may correlate with others related to student performance, such as opportunity to learn, as measured by the mathematics curriculum (Schmidt et al., 2002). Societies that recruit more academically able mathematics teachers may also be able to require a more demanding mathematics curriculum. We do not have measures of opportunity to learn for all the countries in our sample, but we are aware that teacher relative salary and opportunity to learn might be highly correlated factors that contribute to student achievement.

Income inequality in a society might also figure into relative teacher pay and higher student achievement: the greater the income inequality in a post-industrial society, especially in today's technology-oriented global economy, the more likely it is that those with relatively good mathematics skills will receive higher levels of pay than those without such skills. Yet, there are societies that "regulate" income inequality more than others do. Canada, for example, has about the same level of technology use and science-based industries as the United States, but Canada's income distribution is more equal (Deininger & Squire, 1996). Societies have preferences for more or less income inequality, and this preference may influence differences in income between, say, teachers and those in mathematics-intensive professions.

Income inequality in a society may therefore be one variable suggestive of the relative quality of mathematics teachers in that society. The higher the average level of mathematics skills in a society and the more equal the income distribution, the lower the expected cost of recruiting into teaching those with relatively scarce skills, such as high levels of proficiency in mathematics. Income, or gross domestic product (GDP) per capita, correlates highly with the average level of adult educational attainment, which means that educational attainment should reflect the degree of mathematics skill in the society. As such, we can use GDP per capita as a rough approximation of the level of mathematics skills in the society, and income distribution as a rough measure of the cost of recruiting individuals with high mathematics skills into teaching.

Societies with greater income inequality may also be marked by more unequal distribution of teacher skills among students (Chiu & Khoo, 2005). Unequal income distribution may therefore not only influence the *level* of mathematics skills in the

teacher labor force, but also the *distribution* of those skills across social class groups. In societies where income is more equally distributed, teachers with high mathematics skills may be less averse to teaching in schools containing students from lower social class levels than teachers in societies where income is more variable because the social distance between the lower and the higher social classes is smaller. Another possibility is that, in societies with more equal income distribution, classrooms vary less in terms of their teaching conditions than is the case in more unequal societies. Teachers of equal mathematics skills are thus more likely to be found across the spectrum of classrooms in the education system. And if we assume that higher teacher mathematics skills yield a higher payoff in classrooms with students from lower SES backgrounds, we can then also assume that countries with more equal distribution of teacher skills will have higher levels of average student mathematics performance.

If teacher mathematics skills are, indeed, an important factor explaining student performance in mathematics, we should find relationships between student mathematics performance on international tests, such as TIMSS and PISA, and on measures of both GDP per capita (a proxy for the overall level of mathematics skills available in the labor market) and income distribution. We should also find that, assuming we control for GDP per capita and income distribution, students have higher levels of mathematics performance in nations where teacher wages are *higher relative to the wages of workers in mathematics-intensive professions.*

We explore both these notions in the first part of this publication. We briefly summarize the results of our comparison across 20 countries of (estimated) teacher age/income profiles for various years with the age/income profiles of professionals in mathematics-intensive professions. When developing our estimates, we controlled for gender and level of education. We found that, in many of the 20 countries, salaries of teachers are similar to those of professionals in mathematics-intensive occupations. However, in the remaining countries, this is not the case. (The 20 country studies comprise the second part of this report.)

We also, in the first section of the report, estimate the relationship between student mathematics test scores on the TIMSS and PISA mathematics tests, GDP per capita, income distribution, and teachers' salaries relative to the salaries of people of the same gender with a similar level of education (usually completed university) who are employed or trained as scientists. We use country as the unit of observation. The results of this analysis suggest that student performance is positively and statistically significantly related to relative teacher salaries in the case of male (but not female) teachers, even when controlling for GDP per capita and income distribution. We discuss these results and how they might inform continued research on the effect that paying higher relative salaries to teachers potentially has on student mathematics performance.

We need to caution that the results are essentially suggestive, not causal. As we point out in the conclusions, there are several possible reasons for the correlation between teachers' relative pay and higher student performance, only one of which is that higher teacher pay draws individuals with higher mathematics skills into teaching, thereby resulting in better student performance.

2. Teacher Salaries Relative to Salaries in Mathematics-Oriented Occupations

Conceptual framework, methodology, and data for the comparisons of teacher salaries with salaries in other occupations

Conceptual framework

We assume that the lifetime earnings associated with various professional-level occupations have a significant influence on occupational choice. But lifetime earnings are not the only factor influencing choice. Individuals choose occupations because they are drawn to the type of work associated with the occupation, and because they have the abilities that it requires. Often, these abilities are affirmed or even discovered in school, with teachers and other adult role-models influencing choices made by adolescents. Cultural factors, such as gender stereotyping, also push (or even force, through discrimination) individuals to enter certain types of work and not others. Moreover, opportunities for work vary across countries, so occupational choice is not equal everywhere in the world, even for university graduates.

The choice of teaching as a profession is, as with other occupations, influenced by earnings and the aforementioned factors. Teaching mathematics in middle and secondary schools should require significant mathematics skills. In most societies, this level of mathematical ability is not likely to be widely available in the labor force. In many countries, teaching mathematics in Grades 7 to 12 requires a university degree with at least a minor in mathematics and often a university degree in mathematics. Thus, we assume that those who choose to go into mathematics teaching want to become teachers but at some time probably considered other professions where they could apply their mathematics skills. These professions could include a science-based one, the social sciences, or accountancy. Individuals with mathematics qualifications might also consider medicine and the law, but these professions are not so obviously tied to mathematics skills. Thus, we postulate that when individuals with mathematics skills consider teaching as a profession, they (implicitly or explicitly) weigh that decision against the attraction of other mathematics-intensive professions.

Our basic hypothesis is that the greater the difference in economic returns between these other occupations and teaching, the less likely it is that teaching will attract individuals with high levels of mathematics competence. However, we also consider another hypothesis associated with the premise that when differences in salaries between teaching and the other professions are small, teaching has other economic attractions, such as job security and (usually) quite good pension plans—features that are not as likely to characterize other jobs. Our hypothesis is that, under such circumstances, many individuals with high levels of mathematics skills will be induced to enter teaching (whether at the primary, middle, or secondary school level) and will stay teaching once there.

Evidence of a relationship between the relative salaries of teachers and the quality of teaching is not easy to find. In the United States, the subject has been one of considerable controversy. One study there (Allegretto, Corcoran, & Mishel, 2004) estimated the

relative pay of teachers by summarizing the literature on the relationship between teacher quality and relative wages. The authors concluded:

> Existing evidence on the relationship between teacher pay and teacher quality is divided. In the short run, pay increases do not appear to have noticeable effects on the quality of candidates entering the teaching profession. Over the long run, however, trends in relative teacher pay seem to coincide with trends in teacher quality. (p. 6)

Another study (Corcoran, Evans, & Schwab, 2002) combined data from four longitudinal surveys of high school graduates that covered the years 1957 to 1992, to examine whether the propensity for talented women to enter teaching had changed over time. Corcoran et al. found that although "the quality of the average new female teacher" fell only slightly over the period, the likelihood of a female from the top of her high school class eventually entering teaching fell "dramatically from 1964 to 1992—by our estimation, from almost 20% to under 4%" (p. 2).[1] The decline was associated with a corresponding increase in the percentage of teachers associated with the seventh decile of high school test scores. The percentage of teachers associated with the first to sixth deciles remained fairly constant at 35%. Thus, the percentage of A-level students declined and the percentage of B-level students increased, with all this occurring before the sharp decline in teachers' relative wages in the mid and late 1990s.

By implication, then, the *difference in earnings between teachers and other mathematics-intensive professionals provides one estimate of how much a society is willing to pay to try to purchase higher quality mathematics teaching in school.* As we have already stressed, in most countries, teachers of different subjects are not paid different wages, so it may not be possible to increase just the pay of mathematics teachers to induce a more skilled individual to choose teaching. This issue is outside the scope of this study, but is nonetheless one we need to take account of when considering our estimates of the total cost for society of attracting potentially good mathematics teachers into teaching.[2]

Methodology

We constructed age-earnings curves for men and women in mathematics-intensive occupations and in teaching by level of their education (first university degree, Master's degree), so that we could determine how (mathematics) teachers fare compared to their "competing professionals" in each of the countries we studied. We decided it was important to separate the analysis by gender (see Corcoran et al., 2002, discussed above) because the labor markets for men and women in most countries differ, as do salary structures. For 16 of the 20 countries we studied, we were able to estimate age-earnings profiles for two different years, one in the 1990s and the other either in 2000 or beyond. These profiles allowed us to observe possible changes in relative earnings in recent years and to determine whether the trends could be confirmed at different points in time.

1 The key to the study by Corcoran and colleagues is that, in the period they analyze, the labor market for women—who constitute about 75% of the K–12 teaching force in the United States—changed radically. Before 1965, the public school system was almost a monopsonist (single buyer) in hiring university-educated women. Only nursing was a serious competitor. Since that time, job opportunities for female university graduates in other, previously almost exclusively male, professions have greatly increased. Given the trend in relative teacher salaries, this situation means greater difficulty attracting high-achieving female high school graduates into teaching, especially as a long-term career.

2 As we show, some countries, in paying sufficiently high relative salaries to teachers, face a surplus and have sharply reduced the number of teachers being trained in teacher-education institutions and universities. Chinese Taipei is one such case.

A major issue associated with estimating earnings in different occupations, particularly when making comparisons with teaching, is whether to use yearly earnings (salary) or earnings per hour (wages). Because teachers in some countries work fewer than 40 hours per week (even including preparation time—see OECD, 2004a) and, in all countries, work fewer than 12 months per year, their hourly earnings usually compare more favorably than their salaries with hourly earnings in other professions. Many economists consider hourly earnings a better measure of compensation because these allow us to measure the cost of the trade-off between working an hour and engaging in leisure activities. Economists also tend to argue that hourly wages are a better predictor of whether an individual will choose one type of work over another. Teaching offers the possibility of working fewer than 12 months and a somewhat shorter workday (in the classroom), factors appreciated by women in most societies, given that they, even in post-industrial economies, still have primary responsibility for child-rearing.

Nevertheless, for those who are concerned with absolute earnings, and particularly for those who are in economies where it is difficult to get (part-year) vacation jobs, annual earnings probably offer a better means of comparison between teacher earnings and earnings in "competing" occupations. If those teaching do not want time off in the summer, then the value of that time is close to zero. As such, hourly wages calculated on the basis of the fewer annual hours worked by teachers *overestimate* teacher pay relative to remuneration from full-year jobs. Also, as Allegretto et al. (2004) point out, inconsistencies in measuring the number of hours that teachers and other professionals work per week and how many weeks they work per year lead to inaccurate estimates of wages per hour. Accordingly, where possible, we present both measures of earnings in the case studies.

If the relative salary of teachers—and probably the time trend of relative teacher salary—correlates positively with teacher quality, then what we would expect to find is a situation in which the higher the relative teacher salary in a country, the higher the mathematics performance of that country's students. As mentioned, however, teacher salaries may be relatively high mainly because income distribution is more equal in the country; professional salaries are thus equal to one another no matter what the profession.

We could also expect to find that student performance is higher in countries with higher income per capita (better-educated parents) than in coutries with lower income per capita and perhaps, as discussed earlier, in countries with more equal income distribution for reasons related to how educational resources are distributed among students of lower and higher SES (see Chiu & Khoo, 2005, in this regard). Student performance on the TIMSS or PISA tests may also be higher in countries with a lower proportion of students in Grades 8 to 10 because these students represent a more selective group in the potential student population. Equations 1a and 1b describe the

recursive mode that we were interested in estimating.

$$TRS_i = a + b_1 IncDistrib_i + e_i \quad (1a)$$

$$A_i = a^* + b^*_1 IncDistrib_i + b^*_2 GDP/cap_i + b^*_3 TRS_i + b^*_4 Enrol_i + e^*_i \quad (1b)$$

where

TRS_i = teacher relative salary (either male or female ratio) in country i;

$IncDistrib_i$ = income distribution in country i, as measured by the Gini coefficient;[3]

A_i = student mathematics achievement on TIMSS or PISA tests in country i;

GDP/cap_i = gross domestic product per capita in country i, measured in year 2000 US dollars;

$Enrol_i$ = net secondary school enrollment ratio in country i; and

e_i = error term.

In this recursive model, Equation (1a) models the relationship between the overall income distribution in the country and the teacher salary ratio. Here, we would expect the coefficient b_1 to be negative; that is, the more unequal the income distribution, the smaller the ratio between teacher salaries and the salaries in competing occupations. Equation (1b) models the relationship between the student achievement and teacher salary ratio, which is "additional" to the relationship between teacher salary ratio and student achievement through income distribution. This "additional" effect of teacher salary ratio could be the result of the extent to which societies value teachers relative to other professions. We expect that the coefficient b^*_3 would be positive.

Data

We needed a dataset in each country that would allow us to estimate age-earnings profiles by level of education, gender, and occupation. In some countries, these datasets were difficult to obtain. For example, the employment survey for Korea does not include public school teachers, so our earnings estimates in Korea are for private school teachers only. The data for Bulgaria also have limitations because the sample size is so small. Table 1 presents a summary of our data sources for each country.

3 The Gini coefficient, a popular measure of income inequality, is named after its originator, the Italian statistician, Corrado Gini. The Gini coefficient is just one measure of income variability, but it is the most widely reported. It is calculated by plotting the cumulative income earned by each successive proportion of the population against the cumulative proportion of the population. An equal distribution of income would be a 45° line (each successive decile of the population earns an additional 10% of the total income in the economy). The Gini is the area between the plot of the actual cumulative percentages of income and the 45° line divided by the area of the triangle under the 45° line. Thus, the value of the Gini is between 0 and 1. The larger the Gini, the more unequal is the income distribution. If the Gini is close to 1, it means that a very small percentage of the population earns a high fraction of all the income in the economy. See http://en.wikipedia.org/wiki/Gini_coefficient for a more detailed explanation.

One of the problems of comparing Gini coefficients across countries is that Ginis are often based on different measures of income (gross versus net of taxes and transfers, for example) or on different earning units (individuals versus households, for example). In some cases, they are based on household expenditure surveys rather than on income surveys. Gross income is usually less equally distributed than net income. Household income may be more or less equally distributed than personal income, depending on the composition of households, and expenditures are usually more equally distributed than income, because higher income earners usually save a higher percentage of their income than do lower income earners.

In our use of the Gini, we used a Gini based on gross income distribution, usually of household incomes wherever possible. In several countries, we had to approximate income distributions in a recent year because only the Gini of the expenditure distribution was available. In an alternative specification, we also used the ratio of the percentage of income earned by the top 20% of income earners to the percentage of income earned by the lowest 20%. The results differed little from those obtained with the Gini coefficients as the independent variable.

Table 1: Data Sources for Teacher Salary Comparison Studies, by Country, 1990s and 2000s

Country	Mathematics-Oriented Professions		Teaching	
	1990s	*2000s*	*1990s*	*2000s*
Australia	Australian Bureau of Statistics, 1996 Census of Population and Housing	Australian Bureau of Statistics, 2001 Census of Population and Housing	Australian Bureau of Statistics, 1996 Census of Population and Housing	Australian Bureau of Statistics, 2001 Census of Population and Housing
Botswana		Household Survey (2002/03)		Household Survey (2002/03)
Bulgaria	Household Survey (BIHS)	Household Survey (BIHS01)	Household Survey (BIHS)	Household Survey (BIHS01)
Chinese Taipei	Taiwan Manpower Utilization	Taiwan Manpower Utilization	Taiwan Manpower Utilization	Taiwan Manpower Utilization
Chile	Household Survey data (CASEN 1996)	Household Survey data (CASEN 2004)	Household Survey data (CASEN 1996)	Household Survey data (CASEN 2004)
Finland	Finland Statistics Bureau	Finland Statistics Bureau	Finland Statistics Bureau	Finland Statistics Bureau
France	INSEE Employment Survey, 1996	INSEE Employment Survey, 2002	INSEE Employment Survey, 1996	INSEE Employment Survey, 2002
Germany	Federal Ministry of Education and Research (Socioeconomic Panel data)	Federal Ministry of Education and Research (Socioeconomic Panel data)	Federal Ministry of Education and Research (Socioeconomic Panel data)	Federal Ministry of Education and Research (Socioeconomic Panel data)
Hong Kong SAR	Population Census, 1995	Population Census, 2001	Population Census, 1995	Population Census, 2001
Italy		Banca d'Italia Employment Survey		Banca d'Italia Employment Survey
Korea	National Employment Survey, 1996	National Employment Survey, 2005	National Employment Survey, 1996	National Employment Survey, 2005
Mexico	ENIGH 1995	ENIGH 2000	ENIGH 1995	ENIGH 2000
Norway		Statistics Norway, 2005		Statistics Norway, 2005
Philippines	National Statistics Office, Philippine Labor Force Survey, 1995	National Statistics Office, Philippine Labor Force Survey, 2005	National Statistics Office, Philippine Labor Force Survey, 1995	National Statistics Office, Philippine Labor Force Survey, 2005
Singapore	Ministry of Manpower Occupational Wage Survey, 1998	Ministry of Manpower, Occupational Wage Survey, 2004		Ministry of Education (teacher salaries)
Spain		Encuesta de Estructura Salarial, 2002		Encuesta de Estructura Salarial, 2002
Switzerland	Swiss Earnings Structure Survey, 1996	Swiss Earnings Structure Survey, 2004	Swiss Earnings Structure Survey, 1996	Swiss Earnings Structure Survey, 2004
Thailand	Thai Labor Force Survey, 1995	Thai Labor Force Survey, 2003	Thai Labor Force Survey, 1995	Thai Labor Force Survey, 2003
United Kingdom	Quarterly Labor Force Survey #4012, March–May, 1999	Quarterly Labor Force Survey #5211, March–May, 2005	Quarterly Labor Force Survey #4012, March–May, 1999	Quarterly Labor Force Survey #5211, March–May, 2005
United States	Current Population Survey, 1995	Current Population Survey, 2000	Current Population Survey, 1995	Current Population Survey, 2000

Results of the teacher salary case studies

The 20 countries that we studied represent a wide array of economic development levels and national education policy structures. In many, teacher labor markets, teacher-education policies, and schooling curricula are controlled by national education ministries. In others, policies are set in a much more decentralized fashion. For example, in Botswana and Chinese Taipei, education policy is highly centralized, whereas in the United States, teacher salary structures are often determined by school districts, and teacher-education standards are set by states but implemented by highly autonomous university faculties of education. Germany is also highly decentralized in terms of educational policies and education recruitment and training, but the federal government sets salaries nationally.

Table 2 presents a brief summary of the main aspects of the country case studies presented in Part 2 of this report. Almost all of the countries surveyed require primary and secondary teachers to have a university degree, but there are still many teachers in most countries without this qualification. In most countries, the vast majority of primary teachers are women. But this is not usually the case in the secondary schools of many countries, where the majority of the secondary school labor force is male. Teacher labor forces also vary considerably in their age distribution, with countries such as Germany and Italy employing a relatively old teaching force, and other countries, such as the United Kingdom, having a much younger teaching force.

Our main focus in regard to the country studies was on teacher pay *relative to the pay of other professions,* particularly mathematics-oriented professions. Teachers in all these countries are generally paid at the same rate whether they teach mathematics, science, or other subjects. Thus, we compared the pay of teachers as an occupational group with the pay of other professionals with similar education, and we also bisected this comparison by gender. Where possible, we collected separate data for primary and secondary school teachers, given that secondary school teachers usually have different educational requirements and, in some countries, receive higher rates of pay.

Table 3 shows teacher salary ratios in the early 2000s for the 20 countries we studied. We estimated this ratio by measuring the ratio of median earnings of teachers with Bachelor's degrees to the median earnings of those in scientific occupations with Bachelor's degrees, as well as in relation to the age brackets of 25 to 29, 30 to 34, and 35 to 39 (or 35 to 44 in those countries where the 35 to 39 category was not available). Our assumption in setting the age range from 25 to 39/44 was that the relative pay offered to workers during their first 15 to 20 years of work life is an important factor determining workers' choice of occupation.[4] We then averaged the three ratios to get the figure in Table 3 for each country. We estimated this ratio for males and females separately. We also measured the ratio of male to female earnings at the three ages for the science-based occupations. (For some countries, we could have measured ratios of relative hourly earnings, but the number of these ratios available was too small to allow for relevant comparisons with student test scores. We therefore limited ourselves to using median annual earnings.)

4 The gradients of teacher salaries vary from country to country. In some, such as Australia, teacher salaries start out relatively high but are relatively flat in later years. In others, such as Korea and France, starting salaries are relatively lower and the gradient is steeper, which means that senior teachers earn relatively high salaries. Because our estimates give greater weight to the earlier salaries, our results may be somewhat biased.

Table 2: Summary of Country Case Studies of Teacher Labor Markets

Country	Main Characteristics of Teacher Labor Force	Main Characteristics of Teacher-Education System	Salaries of Teachers and Mathematics-Oriented Professionals Compared	Indicators of Mathematics Teacher Supply
Australia	The teaching force has become increasingly feminized and older. The achievement levels of new entrants to the profession are declining. More than 30% of teachers teach in private schools.	The system is highly decentralized among states and territories. Most teachers receive a Bachelor's degree in education or in non-education plus a teaching degree.	Male teachers earn less than all other professionals and much less than those in mathematics-oriented professions. Female teachers do better in relative terms but still earn less than science professionals. Not much change occurred over the period 1996–2001.	Fewer mathematics and science graduates entering teacher-education programs or teaching directly. Seventy percent of middle/high school mathematics teachers have mathematics or mathematics education degrees. Large mathematics teacher shortages forecast, particularly in rural areas.
Botswana	The teaching force is highly feminized and stable at the primary level, and is rapidly increasing at the secondary level, where teachers are increasingly Batswana, and increasingly certified.	The teacher-education system is highly centralized and has separate requirements for primary and secondary teaching certificates. Secondary teachers specialize in subject matter.	Women teachers are paid as much or more than scientists with tertiary degrees. Male teachers are paid well, but not as much as scientists.	Recruitment and hiring is highly centralized in the Ministry of Education. No special effort to recruit mathematics and science teachers.
Bulgaria	Despite the declining status of the teaching profession, teaching is still seen as a good fallback profession in a high unemployment economy. Declining absolute student enrollment is evident in both primary and secondary education. Teachers supplement their income with other jobs.	Teachers are trained in autonomous universities, with requirements set in a very general way by central government. All teachers have a university education, with some exceptions. Hiring is done by school principals with the municipalities providing an approval process.	Female teachers' salaries, but not males', were relatively high in 1995 compared to salaries of engineers/technicians. All teachers lost ground to competing mathematics-oriented professions between 1995 and 2001.	Mathematics preparation is still of high quality in secondary schools. Declining enrollment in schools means there should be no shortage despite growing gap between teacher salaries and salaries for other mathematics-oriented professionals.
Chile	There has been a continuous increase in number of teachers because of expansion of secondary schooling and shift from half-day to full-day school. Teaching force is 70% female; the percentage is even higher in basic education. More than half of all teachers are members of the union; almost all are in the public schools. Almost 50% of teachers teach in private schools and have independent contracts. Public school teachers are much older than private.	Ninety percent of teachers have a university degree. Teacher education is highly decentralized in autonomous universities, and student teachers pay for their education. Grades 5 to 8 teachers train as primary school teachers, and do not need to have a degree in a subject area.	In 1996, both male and female teachers earned much less than engineers, but this changed by 2003, with male teachers earning about the same as engineers and scientists, and female teachers earning as much or more than scientists and engineers.	Despite greatly increased teacher salaries in the 1990s, and improved quality of applicants to teacher-education programs, poor preparation in subject matter for basic-education teachers remains an important problem.
Chinese Taipei	About 68% of primary and 60% of secondary teachers are female. Slight reduction in number of K–12 students, but the government is also reducing class size, so number of teachers is increasing somewhat.	Secondary school teacher education students attend four-year normal universities; primary student teachers attend teachers' colleges. Can also be trained in universities in schools of education. Admission to teacher-education programs is very competitive. Few teachers have a Master's degree.	Teachers are well paid. Female teachers with a Bachelor's degree earn about the same as scientists and non-scientists. Male teachers earn somewhat less than competing professionals. Both male and female teachers made gains relative to others between 1997 and 2004.	Large supply of science and technology graduates (one-half of recent college graduates are in science and technology). More than sufficient candidates for teacher education; in recent years, the government has severely reduced the number of students in teacher-education programs.

Table 2: Summary of Country Case Studies of Teacher Labor Markets (contd.)

Country	Main Characteristics of Teacher Labor Force	Main Characteristics of Teacher-Education System	Salaries of Teachers and Mathematics-Oriented Professionals Compared	Indicators of Mathematics Teacher Supply
Finland	Seventy-two percent of primary and lower-secondary teachers are women. Teachers are mostly in their 40s and 50s, a situation that means a potential future shortage of teachers, especially in rural areas.	Teacher education is provided by 11 universities and five vocational teacher-education colleges. Fairly selective entrance requirements for primary school teacher-education programs (only 10% to 15% of applicants approved). Subject teachers apply to subject departments, and there is some shortage of applicants into some programs. Most teachers have a Master's degree.	Teachers with a Bachelor's degree earn similar salaries to scientists and engineers, but teachers with Master's degrees earn considerably less than scientists and engineers, and they earn somewhat less than all other occupations requiring graduate degrees. This situation is particularly true for male teachers.	About 15% of subject-matter teachers, especially males, are leaving teaching for private-sector jobs. Shortage of mathematics and science teachers.
France	Seventy-eight percent of primary teachers, but only 57% of secondary teachers are women. About 26% of all teachers are over 50 years old. School enrollment is not increasing.	Teachers must have completed a university degree and prepare for a selective entrance examination while studying at a teacher-education institute (IUFM). Once they pass, they must study a second year at the IUFM as a paid trainee, and then pass a qualification examination. They then become full teachers.	Male and particularly female teachers (both primary and secondary) earned less than scientists and engineers in both 1995 and 2002. Gap widened between 1995 and 2002, especially for females.	Because of relatively high unemployment in France, there are many more applicants for teaching posts than teaching posts available. This situation continues despite the relatively low salaries that teachers receive.
Germany	Primary teaching force is 80% female, but at the secondary school level, about 57% of teachers are males. About one half of all primary teachers are over 50 years of age; 56% of secondary teachers are over 50. This age profile may pose problems in filling posts at that level.	States *(lander)* are responsible for teacher certification, and set the examinations that prospective teachers must sit on completing their university/teacher-education college studies. New teachers then follow a two-year internship that includes supervised teaching and further courses, followed by a second state examination. GDR teachers have less teacher education.	Teachers were paid, on average, more than scientists and social scientists in 1995, particularly those in the older age brackets. However, by 2000, male teachers in particular were being paid relatively less. It seems that teachers' salary position is eroding somewhat.	Student enrollment is declining in most states, which helps make the supply of mathematics teachers adequate.
Hong Kong SAR	The number of secondary teachers continues to rise, but the primary student population is declining. Fifty-five percent of teachers are females. The examination grades of students going into teaching are lower than those of students in other fields.	Minimum requirement is a post-secondary diploma, but 75% of primary and 92% of secondary teachers have university degrees. Many teachers are teaching "out of field," especially in English. Most teachers train in a few public universities.	Teachers are relatively well paid. Teachers with mathematics/science degrees earn as much as mathematics and science professionals. There was some decline in relative teacher salary position from 1996 to 2001.	No apparent shortage of mathematics teachers. Because teacher salaries are competitive, mathematics majors continue to enter teaching.

Table 2: Summary of Country Case Studies of Teacher Labor Markets (contd.)

Country	Main Characteristics of Teacher Labor Force	Main Characteristics of Teacher-Education System	Salaries of Teachers and Mathematics-Oriented Professionals Compared	Indicators of Mathematics Teacher Supply
Italy	Although the student population is decreasing, the teacher force continues to increase, due mainly to changing policies for disabled students and subject offerings. Ninety-five percent of primary teachers are women; 60% of secondary teachers are women. The waiting lists for teacher assignment are even more feminized. The majority of the teaching force is over 45 years of age.	Since 1998, primary teachers have needed a university degree. Secondary teachers must have an undergraduate degree in the subject they are teaching and a postgraduate degree plus an examination pass in that subject and in teaching. Many teachers have only secondary-level degrees. Hiring is based on a competitive examination, but many teachers take short courses that allow them to teach "temporarily."	Italian female teachers with university degrees are relatively well paid compared to personnel in the science professions, but male teachers earn less than engineers and scientists. Overall, net salaries in all these professions are not high.	Shortages of qualified teachers exist in border areas and rural areas. There are some shortages overall of secondary school mathematics teachers, although a declining student population should assure an adequate supply of teachers in the future.
Korea	Teachers are 72% female in primary school, but only 32% in high schools. The socioeconomic status of those who become teachers has declined in recent years. The recession of the late 1990s increased the number of those applying to become primary teachers. Achievement levels of student teachers have increased, and there is oversupply in secondary schools.	Most primary teachers are trained in the teachers' colleges of the National University of Education. Secondary teachers are trained mainly in departments of education, colleges of education, and in universities. All prospective teachers must take subject courses. Even elementary teachers have to take many mathematics courses; secondary teachers take even more. Teachers must also sit a national employment examination.	It seems that secondary mathematics teachers earn as much or more than do scientists and engineers with Bachelor's degrees. Primary school teachers earned somewhat less in 1996. Relative salaries changed little between 1996 and 2004. Teachers with a Master's degree earn less than employees in competing professions.	Some shortages occurred in the early 1990s in primary schools, but not in secondary schools or middle schools.
Mexico	The teaching force is less feminized than it is in other countries, with only 65% of primary school and 43% of basic secondary school teachers women. Although the supply of teachers is strongly influenced by the main labor union, there is continuous relative growth of private education, especially at the secondary level. Teachers hired by primary schools are not unionized.	Primary school teachers were traditionally trained in normal schools, but since the mid 1980s, all teachers have been required to obtain university-level degrees, at either a university or a post-secondary normal school. Secondary teachers usually obtain university degrees with a specific subject major, but a 2004 survey showed a significant percentage with lower levels of schooling.	Teacher salaries rose relative to those of other professionals in the early 1990s, but fell somewhat in the late 1990s. The annual earnings of male secondary teachers are considerably lower than the earnings of personnel in mathematics-oriented professions for males but are fairly comparable for female secondary teachers. Both males and females lost relative ground during the period 1996 to 2004.	There is a considerable shortage of qualified mathematics and science teachers, particularly in rural areas, smaller cities, and poorer states. This situation is evident despite the fact that salaries for teachers—especially female teachers—are competitive with the salaries of female workers in other professions.
Norway	The teaching force is 73% female at the primary and lower-secondary levels. There are more males at the upper-secondary level. Average age is quite high, with many teachers near retirement, especially at the upper-secondary level.	All teachers must have a tertiary-level degree from a teacher-education college or a university. More than 90% of teachers take a "short course" (three to four years) university degree. Only six percent of teachers are unqualified.	Teacher salaries are lower than those of scientists and considerably lower than those of engineers. The salary gap for male teachers is higher than it is for females.	Shortages exist for teachers of mathematics, English, and Norwegian. About 20% of the economically active teachers work in sectors other than schools.

Table 2: Summary of Country Case Studies of Teacher Labor Markets (contd.)

Country	Main Characteristics of Teacher Labor Force	Main Characteristics of Teacher-Education System	Salaries of Teachers and Mathematics-Oriented Professionals Compared	Indicators of Mathematics Teacher Supply
Philippines	Eighty-nine percent of primary teachers and 75% of secondary teachers are females. The teacher force is growing relatively slowly, but the number of people who graduate with a teaching degree is increasing much more quickly. The teaching force is relatively old—43% of all teachers are over 50 years of age.	A four-year education degree is required for teaching primary or secondary school. Secondary teachers usually major in a particular subject. Prospective teachers must pass the Licensure Examination for Teachers, which has an annual pass rate of only 30%.	Teachers have to teach 196 days per year and 30 hours per week. Class sizes are large. Teachers are paid more than most other professionals, but receive less than scientists. Relative teacher salaries declined between 2001 and 2006.	There are significant shortages of mathematics and science teachers. The anticipated large number of retirements could worsen these shortages. Only 1.5% of secondary education degree holders major in science or mathematics.
Singapore	Teaching is primarily a female occupation at the primary level (83% of teachers). At the secondary level, 66% of teachers are female. Teaching is considered a challenging occupation, but resignation rates have been contained to just over two to three percent annually. Each year, the Ministry of Education receives about 18,000 applications, from which 2,000 teachers are recruited. The approximately 400 expatriate teachers in Singapore make up less than one percent of the education service.	Primary school teachers can hold a Diploma in Education (two years), a BA (Education) or BSc (Education) (both four years), or a postgraduate Diploma in Education (Primary) (one year after gaining a degree). Secondary school teachers hold a postgraduate Diploma in Education (Secondary) (one year after gaining a degree relevant to the subjects they will be teaching).	Both male and female teachers appear to be paid less than accountants or engineers, but the differences are not great. The Ministry of Education periodically reviews the salary package for education officers and attempts to keep it competitive with what peers with similar qualifications and backgrounds earn in the private sector.	There is no apparent systematic shortage of teachers. On the contrary, the ministry is on track to recruit an additional 3,000 teachers by 2010 to further improve education. This situation would allow schools to reduce student–teacher ratios and to introduce innovative programs.
Spain	Despite declining student enrollment, the number of teachers continues to increase, reducing student–teacher ratios. Seventy-eight percent of primary and 52% of secondary teachers are female; the percentages have increased over time, rapidly feminizing the teaching force. There is very little attrition in the teacher labor force.	Primary teachers take three-year courses at university; secondary teachers take a four-year degree in the subject they will teach and a one-year pedagogy course. This course is considered inadequate to prepare a good teacher. Teachers have to sit and pass a competitive examination in order to secure a teaching position.	Spanish teachers are paid relatively well compared to teachers in other OECD countries. Secondary teachers are paid much more than primary teachers. However, even secondary teachers are paid much less than scientists and people in business and the social sciences. These pay differentials are especially large for people 35 years of age and over.	Because of a declining school population, there is no apparent shortage. However, only a few teachers have mathematics and science degrees.
Switzerland	Seventy-two percent of primary school teachers are female, but this proportion drops to 32% at the upper-secondary level. The teaching force is not old, but still has a high turnover—about eight percent per year. There is a major shortage of teachers at the lower-secondary level despite a low growth in student enrollment.	Primary and lower-secondary teachers must have undertaken tertiary education, usually in a teacher-education program in a university (three to four years). Upper-secondary teachers have degrees in a given discipline, with a teaching degree from a teacher-education program (five years).	Teacher salaries for men and women were comparable with those in mathematics-oriented professions in 1996. However, by 2004, this situation had changed, with teachers losing ground to research and analysis /programming professionals.	Qualified teacher shortages exist, especially at the lower-secondary level.

Table 2: Summary of Country Case Studies of Teacher Labor Markets (contd.)

Country	Main Characteristics of Teacher Labor Force	Main Characteristics of Teacher-Education System	Salaries of Teachers and Mathematics-Oriented Professionals Compared	Indicators of Mathematics Teacher Supply
Switzerland	Seventy-two percent of primary school teachers are female, but this proportion drops to 32% at the upper secondary level. The teaching force is not old, but still has a high turnover—about eight percent per year. There is a major shortage of teachers at the lower secondary level despite a low growth in student enrollment.	Primary and lower secondary teachers must have undertaken tertiary education, usually in a teacher education program in a university (three to four years). Upper secondary teachers have degrees in a given discipline, with a teaching degree from a teacher education program (five years).	Teacher salaries for men and women were comparable with those in mathematics-oriented professions in 1996. However, by 2004, this situation had changed, with teachers losing ground to research and analysis / programming professionals.	Qualified teacher shortages exist, especially at the lower secondary level.
Thailand	Primary teaching is characterized by a huge oversupply of teachers. The government is promoting early retirement to ease this glut. Studies suggest that most teachers have low university entrance examination scores, so represent a less "capable" group of professionals. Only 58% of primary and 50% of secondary school teachers are female. On average, teachers are 45 years of age.	Teachers generally obtain two-year diploma or Bachelor's degrees from a variety of teachers' colleges and universities. The government is now moving to four years of coursework and one year of a teaching practicum for all teachers. The government is also offering scholarships and job security guarantees to attract better-qualified students into teaching.	In 1996, female teachers earned approximately the same salaries as scientific and non-scientific professionals, but a gap then developed. For male teachers, the small gap existing in 1996 grew larger thereafter in favor of non-teachers. Oversupply of teachers in general is driving teacher salaries down compared to the salaries offered in other professions.	Some national programs are offering scholarships to prospective mathematics and science teachers to relieve shortages of teachers with qualifications to teach these subjects. However, declining teacher salaries is making it more difficult to recruit teachers with these special skills.
United Kingdom	The teacher workforce is aging and becoming increasingly feminized (83% in primary and 55% in secondary). Sixty percent of teachers are 45 years of age and over.	Teachers in England must earn qualified teacher status by completing either an undergraduate or a postgraduate teacher-education program. Most teachers (55% of primary and 92% of secondary) now complete a postgraduate program.	The weekly earnings of secondary teachers with Bachelor's degrees are higher than the salaries of both science and engineering professionals; those teachers with higher degrees also fare well. Older scientists and engineers do better than teachers. Primary teachers also did well relative to other occupations in 1999, but this situation changed against teachers from 1999 on.	Shortages have developed in mathematics, science, business, and technology. Teachers with these qualifications qualify for various existing programs that offer new teacher bonuses and teaching grants.

Table 2: Summary of Country Case Studies of Teacher Labor Markets (contd.)

Country	Main Characteristics of Teacher Labor Force	Main Characteristics of Teacher-Education System	Salaries of Teachers and Mathematics-Oriented Professionals Compared	Indicators of Mathematics Teacher Supply
United States	The teacher workforce has increased steadily in the past 25 years, while the number of primary and secondary students has dropped. This situation has reduced the student–teacher ratio.	Teacher education is highly decentralized. States set requirements, and universities train the teachers, so teacher education varies from state to state and from university to university. All teachers must have a university degree. These are usually education degrees, with specialization in a particular field for secondary school teachers. However, many secondary school teachers teaching mathematics have not trained in mathematics. Across the system, some teachers are not certified in a traditional way. The proportion of such teachers is sometimes higher in the urban areas than in the rural areas of the nation.	Teacher salaries relative to "comparable" professions have been falling since the late 1980s. Male teachers earn about 65% of scientists' salaries, and female teachers earn about 74% of scientists' salaries.	There are considerable shortages of mathematics and science teachers, particularly in urban school districts, possibly because the salaries for teachers relative to those of other professionals are not competitive.

Table 3 contains a number of surprises. For example, Chile and Mexico, both middle-income countries with very unequal income distributions, pay relatively high salaries to teachers, whereas several developed countries, such as France, Spain, and Germany, with relatively equal income distributions do not. Another surprise is the very low relative pay of teachers in the United States.

We can identify, from the table, three sets of countries in the sample of 20. The first set comprises those countries that pay relatively high salaries to teachers (90% or more of a scientist's salary). The second set includes those countries that pay teachers between 80% and 90% of a scientist's salary. The third includes those countries that pay relatively low salaries to teachers (< 80% of a scientist's salary).

The first (high-paying) group includes Chile, Chinese Taipei, Finland, Hong Kong, Korea, Singapore, and the United Kingdom. In Mexico, salaries of female teachers are high relative to those of female scientists. If we assume that most teachers in Finland have Master's degrees, Finland falls into the middle-paying group because Finnish teachers would be compared to higher-paid scientists with Master's degrees.

Table 3: Teacher/Scientist Earnings Ratios for Bachelor's Graduates, by Gender, Male/Female Scientist Earnings Ratio, GDP per Capita, and Gini Coefficients, by Country, early 2000s

Country	Male Teacher/ Scientist Salary Ratio	Female Teacher/ Scientist Salary Ratio	Male/Female Scientist Salary Ratio	GDP per Capita (2000 PPP$)	Gini Coefficient (x 100)	Net Secondary Enrollment Ratio (2004)
Australia 2001	0.77	0.84	1.22	26,181	35.2	85
Botswana 2002	0.60	0.88	1.76	7,702	56.0	60
Bulgaria 2001	0.55	0.81	1.90	6,229	31.9	88
Chile 2003	0.93	0.97	1.10	9,197	57.5	70
Chinese Taipei 2004	1.04	0.98	1.03	25,000	30.8	88
Finland 2004	0.90	0.90	1.11	25,141	25.6	94
France 2002	0.70	0.75	1.09	25,318	32.7	96
Germany 2000	0.79	0.85	1.14	26,075	38.2	93
Hong Kong SAR 2001	1.14	1.25	1.21	25,784	43.4	78
Italy 2004	0.88	0.89	1.50	24,936	36.0	91
Korea 2004	0.99	0.91	0.97	15,202	31.6	88
Mexico 2004	0.78	1.07	1.58	8,920	55.0	64
Norway 2005[a]	0.82	0.90	1.16	35,132	25.8	96
Philippines 2006	0.74	0.85	1.16	3,984	46.1	61
Singapore 2004	0.94	0.94	1.05	23,494	42.5	88
Spain 2002	0.79	0.83	1.16	19,969	32.5	97
Switzerland 2004	0.86	0.89	1.09	28,526	33.1	83
Thailand 2005	0.63	0.67	1.12	6,350	43.2	57
United Kingdom 2005	1.22	1.19	1.05	24,675	36.0	95
United States 2000	0.64	0.74	1.21	34,134	40.8	89

Note: [a] For Norway, the salary ratio is estimated for those individuals 30 to 39 years of age and 40 to 49 years of age, with both long- and short-course degrees weighted by the number of teachers and scientists in the sample with each type of degree. Given differences in the number of years of education completed by teachers and scientists with each type of degree, this estimate provides a more accurate one for the salary ratio.

Source: Salary ratios—salary studies in this book; GDP per capita, Gini coefficients, and net enrollment rate—World Bank (2005). Salary ratios are estimated for the three lowest age groups and then averaged.

The second (middle-paying) group contains Italy, Norway, and Switzerland. However, several countries—Australia, Botswana, Bulgaria, Germany, the Philippines, and Spain—pay their female teachers relatively well, but male teachers receive relatively low salaries compared to scientists with the same level of education. This situation is a result in these countries of males in non-teaching professions being paid substantially more than females in non-teaching professions.

The third (low-paying) group comprises France, Thailand, and the United States. Australia, Botswana, Bulgaria, Germany, Mexico, the Philippines, and Spain also pay their male teachers relatively low salaries, although the pay rates of female teachers tend to be better than those of female scientists.

As we noted above, these relative salaries may not be associated with the quality of teacher education. Our basic assumption is that although higher relative teacher salaries attract people with higher academic skills into teaching, teacher education itself can be an important influence on the quality of education delivered by teachers. This situation varies from country to country, perhaps irrespective of how much teachers are paid relative to other professions.

The average level of high school graduates' mathematics knowledge could also be an important factor influencing the overall quality of mathematics teaching in a particular country. Let us assume that mathematics content knowledge is an important factor in determining mathematics teachers' quality and that the pool of mathematics knowledge is much greater in some countries than in others. In those "higher mathematics knowledge" countries, paying even relatively low salaries for teachers could mean that those who become teachers (drawn from the lower-scoring high school mathematics students) might still know more mathematics than teachers in another country with poor mathematics training but paying higher relative teacher salaries and attracting above-average high school graduates into the profession. A comparison of the relative salaries of these two countries would yield biased results. To express this matter another way, the relationship between teacher quality and student performance may be partially endogenous; that is, higher student mathematics performance influences the "quality" of young people available to teach mathematics, while the "quality" of mathematics teachers influences student performance.

The Pilot Mathematics Teacher Education Study (P-TEDS), which focuses on six of the countries included in our study, suggests that at least in these countries (Bulgaria, Chinese Taipei, Germany, Korea, Mexico, and the United States), important differences exist in terms of the level of mathematics content knowledge among those people entering teacher-education programs and how much mathematics and mathematics pedagogical content knowledge these student teachers acquire during their studies (Schmidt et al., 2008). The Mathematics Teacher Education Study (TEDS-M) projects, of which this publication is a part, will provide further detailed information on the level of mathematics that prospective teachers in many other countries bring into teacher-education programs and how much mathematics, mathematics pedagogy, and general pedagogy they learn in their teacher-education programs. All these variables, entwined with teachers' relative salaries, can influence the "quality" of those who end up teaching mathematics, and hence can have an impact on student performance.

However, our measure of relative salaries should still tell us something about people with mathematics aptitude who want to enter teaching as a profession, and how much these people influence the quality of teaching, at least in mathematics. It is possible that countries willing to pay teachers higher relative salaries may also be the ones that invest more in teacher-education programs, and demand more of such programs in terms of the quality of the teaching professionals they produce. Although the P-TEDS results are limited to only six countries, they provide evidence that this is the case.

Attracting better-qualified individuals into teaching and then educating them to be better teachers may be a good strategy to raise the quality of education, but it is also probably very costly. That cost may be worthwhile if we are convinced that it yields results in the form of higher student academic achievement. In the next section, we relate these salary ratios and other variables to student performance.

3. Teacher Relative Pay and Student Performance

Income distribution across countries and student performance

If better student performance is positively related to higher relative teacher pay because of a more equal income distribution, we could expect, for example, that societies with a more equal income distribution will generally be societies with relatively equitable pay scales across occupations. Thus, differences between teacher pay and pay in other occupations are likely to be smaller in these societies than in societies marked by large income inequalities. One question we consequently decided to explore was this: Does student performance across countries and regions of countries relate to income inequality? We considered that an answer to this question would provide a clue as to whether the main story about student performance and teacher pay is about income distribution rather than societal emphasis on paying teachers more.

To test the proposition that student performance may relate to income inequality at the national level, we used the reported results of two international tests of mathematics—Trends in International Mathematics and Science Study (TIMSS), administered by the International Association for the Evaluation of Educational Achievement (IEA), and Progress in International Student Achievement (PISA), administered by the Organisation for Economic Co-operation and Development (OECD).

The TIMSS assessment measures have been given to fourth and eighth graders in many countries over several iterations: 1995 (also given to seventh graders in this year), 1999, 2003, and 2007. TIMSS focuses on mathematics and science. The PISA assessment measures have also been administered in many countries—to 15-year-olds—with iterations occurring in 2000, 2003, and 2006. PISA focuses on mathematics, science, and reading. The two programs of study have somewhat different purposes: TIMSS is more interested in assessing the effect of curriculum differences across countries; PISA is more concerned with how well students are learning critical thinking skills needed for working in the 21st-century labor market.

We estimated the relationship of the average test scores on the studies' tests to income inequality, controlling for GDP per capita and using income inequality data from all countries participating in TIMSS and PISA for which such data were available. There are many measures of income inequality; each has its particular advantages and disadvantages in estimating the distribution of income. For our estimates, we used the Gini coefficient. We took our estimates of the coefficients from two large databases assembled by the World Bank (World Bank, 2005; see also Deininger & Squire, 1996).

We regressed the average mathematics scores in each test by country on the most recent Gini coefficient (multiplied by 100) available for that country and the GDP per capita in purchasing power parity dollars (PPP$) for the year 2000. For each test, the relationship between average test score and the Gini coefficient was negative and statistically significant. The coefficient for the GDP per capita was positive and usually statistically significant (except for TIMSS 1995). Table 4 presents the results. The results suggest that the more equal the income distribution and the higher the GDP per capita in a country, the more likely it will be that students attain the higher average test scores. We also tried other specifications, including controlling for the country's total population

and the percentage of the age cohort in lower-secondary education. The coefficient of GDP per capita changed somewhat with the inclusion of total population, but the Gini coefficient remained highly robust.

Table 4: National Mathematics Test Scores, Gini Coefficients, and GDP per Capita, by Test and Year

Variable	TIMSS 1995	TIMSS 1999	TIMSS 2003	PISA 2000	PISA 2003
Gini Coefficient (x 100)	-2.964*** (-3.18)	-3.454*** (-3.12)	-3.364*** (-2.90)	-2.962*** (-2.85)	-3.028*** (-3.59)
GDP per Capita (PPP$)	0.0010 (1.22)	0.0036*** (3.39)	0.0027*** (2.79)	0.0023*** (2.85)	0.0021*** (3.41)
Intercept	608.7	565.4	569.9	534.4	545.0***
Adjusted R^2	0.30	0.47	0.39	0.42	0.50
N	36	35	36	38	36

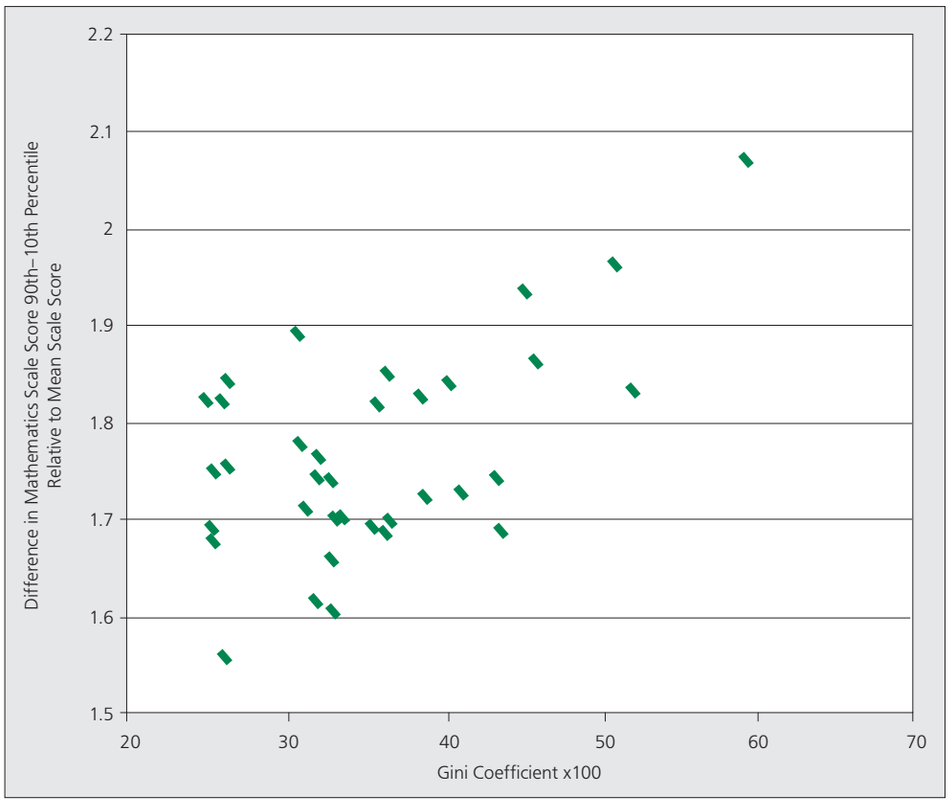
Note: ***Statistically significant at 1% level.
Source: IEA TIMSS 1995, 1999, 2003; OECD PISA 2001, 2004.

One reason why average test scores might be higher in countries with more equal income distribution is that students from low-income families in such countries are relatively better off than students in economies with similar levels of average GDP per capita but greater inequality. If, as Chiu and Khoo (2005) suggest, income inequality correlates positively with inequality in the distribution of teacher qualifications across schools, then shifting teacher skills from higher to lower income schools could have a substantial impact on lower-income students in countries with greater income inequality. High-income students' performance should be less affected by income distribution differences among countries.

We tested this proposition in two ways. First, we estimated the difference between the mathematics scale score of the highest scoring 10% of test-takers in each country and the scale score of the lowest scoring 10% of test-takers relative to the overall mean of the mathematics scale score. We then ran that computation against the country's Gini coefficient. Second, we estimated the equations given in Table 4 above for the average test scores of the lowest 10% of performers, the lowest 25% of performers, and the highest 10% of performers in each country.

The plot of the relative mathematics scale score differences from PISA 2003 against the Gini coefficients of income distribution in 2000 (Figure 1) showed a highly significant positive relationship (statistically significant at the 0.1% level). Table 5 shows that the Gini coefficient related to the relative scale-score differences between the highest-scoring 10% and the lowest-scoring 10% of test-takers was about 0.002. Thus, what is evident to us, in addition to the positive relationship between mean test score and greater income equality, is that the more equal the income distribution, the more likely it will be that the difference in achievement scores between high- and low-scoring students is low when those scores are compared against the mean achievement score. For every 10 points of Gini (the difference between Sweden and the United States, for example), we found that the relative difference in scale score between the lowest- and the highest-scoring students increased by about two percent.

Figure 1: Income Inequality (Gini Coefficients) and the Difference in PISA Mathematics Scores between the Highest 10th Scale Score and the Lowest 10th Scale Score Relative to the Mean Mathematics Scale Score, by Country, 2003



Source: OECD PISA 2003.

The relationship between test score and income inequality also seems stronger across countries for lower-scoring students than for higher-scoring students (Table 5). Although the absolute coefficient of the Gini is smaller for the lower-scoring students, the increase in the mean test score in percentage terms relative to a decrease in the Gini coefficient is much greater for those same students. Also, the statistical significance of the coefficient is higher for the lower-scoring students; so, too, is the R_2 of the regression estimate. This outcome may be because of a ceiling effect at the upper end of the test scores.

However, the larger impact of income inequality on lower-scoring students may represent a resource allocation effect. Thus, in societies with greater income equality, the lowest-scoring students may receive poorer resources (teacher quality, for example) in their schools than do their counterparts in societies with greater income equality. Furthermore, lower-scoring students may be more negatively affected than higher-scoring students when the quality of their schools is lower, compounding the negative impact of poorer resources allocated to schools with lower-scoring students.

Our tentative conclusion, then, is that there is some evidence that greater income equality correlates positively with average scores on international tests, assuming we control for GDP per capita. This outcome, in turn, seems to be positively related to the relative difference in each country between those students with the lower scores and those students with the higher scores, mainly because the scores of the former are relatively higher in countries with more equal income distribution.

Table 5: PISA 2003, Lowest and Highest Test Scores as Function of Income Distribution and GDP per Capita

Variable	Dependent Variable			
	Score Diff. of Highest 10% to Lowest 10% Relative to Mean Score	*Mean Score of Lowest 10% of Test Scorers*	*Mean Score of Lowest 25% of Test Scorers*	*Mean Score of Highest 10% of Test Scorers*
Gini Coefficient (x 100)	0.002** (2.85)	-2.917*** (-4.03)	-3.148*** (-3.96)	-3.904*** (-3.92)
GDP per Capita	-0.0000024*** (-3.40)	0.0017*** (3.06)	0.0018*** (2.90)	0.0017** (2.19)
Intercept	0.52	416.4	485.3	714.9
Adjusted R^2	0.41	0.53	0.52	0.46
N	36	36	36	36

Note: **Statistically significant at 5% level of significance; ***statistically significant at 1% level.
Source: OECD PISA 2003.

Student performance and income distribution within countries

We now turn to similar estimates across states *within the same country*. We use two examples—Mexico and the United States.

Mexico

During its participation in PISA 2003, Mexico drew random samples of 15-year-olds in each of 31 (of the 32) states that took part in the study. (The data from one state, Michoacan, could not be collected in that year.) As was the case in the international survey across countries, PISA test results for public school students across states correlated negatively and significantly with the Gini coefficient of income distribution in each state, even when GDP per capita in the state was controlled for (Table 6). When we added other controls for the percentage of the age cohort in each state attending higher secondary school and the percentage of those in the PISA sample in each state attending higher secondary school, the coefficient of the Gini was smaller but still statistically significant at the 5% level.

As was the case with the cross-national estimates, the independent variables explained a relatively high fraction of the total variance in test scores across states. The coefficients for the percentage of the age cohort in upper-secondary school and for the percentage of 15-year-olds taking the PISA tests and attending upper-secondary school (as opposed to still being in middle school) were what we had predicted (negative for the percentage attending higher secondary in each state and positive for the percentage of the PISA test-takers in each state attending higher secondary), and both were statistically significant. Thus, the states in which a relatively high percentage of 15-year-olds were attending school were likely to be the states where students had the lower PISA scores, other factors being equal. Also, the states where a higher percentage of 15-year-olds who took the PISA test were in Grade 10 rather than in Grade 9 were likely to be the states with students who gained the higher scores on the PISA tests, all other factors being equal.

Table 6: Mexico, PISA 2003 Mathematics Scores, by State, as a Function of GDP per Capita and Income Distribution, Public School Students Only

Variable	Model I	Model II
Gini Coefficient	-1.845** (-2.49)	-1.792** (2.05)
GDP per Capita	0.0021** (2.65)	0.0020*** (2.74)
Percentage of Age Cohort in Higher Secondary School		-2.129** (-2.60)
Percentage of Test-Takers Attending Higher Secondary School		1.786** (2.72)
Intercept	464.2	429.9
Adjusted R^2	0.39	0.50
N	31	31

Note: **Statistically significant at 5% level of significance; ***statistically significant at 1% level.
Source: Vidal and Diaz (2004).

The United States

In the United States, samples of students from Grades 4 and 8 are given National Assessment of Educational Progress (NAEP) tests. The tests are conducted every two years, and the results are used widely as measures of student learning in mathematics and reading. The Economic Policy Institute (EPI) estimated the wages of the top 20% and lowest 20% of wage-earners by state from 1978 to 1980 and from 1996 to 1998. We made a series of estimates of the relationship of 2003 NAEP scores by state to the ratio of wage rates and income per capita by state. We also estimated changes in NAEP mathematics scores from 1992 to 2003 as a function of changes in income distribution and income per capita. As Table 7 shows, our estimates of functions match those in Tables 4 and 6.

Table 7: United States, NAEP Scale Scores by State as a Function of Income per Capita and Wage Ratio of Highest 20% to Lowest 20% of Wage Earners

Variable	NAEP 2003, Grade 4			NAEP 2003, Grade 8		
	All	*Whites*	*African Americans*	*All*	*Whites*	*African Americans*
Wage Ratio 1996–1998[a]	-1.572*** (-3.87)	-0.074 (-0.22)	0.336 (0.63)	-2.421*** (-4.34)	-0.662 (-1.35)	0.328 (0.47)
Income per Capita 1999	0.636*** (3.96)	0.774*** (6.05)	0.331 (1.65)	0.765*** (3.46)	0.665*** (3.42)	0.486 (1.87)
Intercept	233.1	221.9	203.9	280.9	274.4	236.0
Adjusted R^2	0.36	0.41	0.02	0.36	0.18	0.04
N	50	50	41	50	50	40

Notes: [a] Wage ratio of the top 20% of wage earners to the bottom 20% in each state. *** Statistically significant at 1% level of significance.
Source: Allegreto, Corcoran, and Mishel (2004).

The results suggest that student performance in mathematics across states relates to income distribution in much the same way as it does across countries and across the Mexican states: the larger the ratio of wages at the top to wages at the bottom (i.e., the more unequal the wage distribution), the lower the average student performance. Proportionately, the relationship is similar for Grade 4 and Grade 8 student performance. However, when we divided the students into the main racial/ethnic groups, the correlation with wage distribution did not hold up. This finding suggests that much of the wage variation relates to test score variation because of variation in the proportion of African Americans (or Hispanics) and Whites in the student populations of the states. And, in contrast to the outcome for the international data, wage inequality in the states did not relate significantly to the test scores of students in the lower income brackets (in this case, African American students) at either Grade 4 or Grade 8.[5]

Further estimates using changes in wage ratios (changes in income distribution) and the economic growth rate as independent variables, and the change in NAEP mathematics scores during 1992 to 2003 as the dependent variable, produced no significant results.

Income distribution and teacher relative pay

The way in which income distribution among countries and states within countries relates to test score differences raises interesting questions about the impact that social class differences may have on average school performance. The United States data suggest that much of the class social difference reflected in wage differences probably occurs between different races/ethnicities in each state, particularly between Whites and the largest minority groups, African Americans and Hispanics. Thus, the results suggest that the larger the social class differences in a state or country, the lower the *average* student performance in that state or country will be, even if we control for the average income per capita.

Composition effects may explain part of this relationship. In a certain range of GDP per capita, the larger the economic distance between the higher and the lower social class groups, the larger the lower social class group as a proportion of the total population is likely to be. However, there may be another explanation for the results. In states and countries with more unequal wage or income distributions, teachers may be paid relatively less compared to people in mathematics-oriented professions or even non-mathematics professions, both of which provide possible alternatives to teaching for university graduates. Hence, if graduates from university can earn much more in non-teaching professions than they can earn teaching in countries or states with more unequal income distributions, we would expect to find relatively few people entering teaching with the mathematics skills they need to become excellent teachers of mathematics. This scenario might be particularly true for middle school/lower-secondary school teachers because, in many countries, such as Chile and Mexico, and in many of the states of America, primary school teachers are not subject to the more stringent subject-based pre-service education required of secondary school teachers.

There is mounting evidence that teacher quality, as measured in part by teacher ability, relates to student performance. (For studies relating to the United States, see Clotfelter

5 We also tested if the 2003 White/African American Grade 4 mathematics test score ratio related to wage inequality across states, and we controlled for income per capita and for whether the state was in the South. Whites scored significantly higher relative to African Americans in higher-income-per-capita states. The coefficients of wage inequality and whether the state was in the South were not significantly different from zero.

et al., 2007; Ehrenberg & Brewer, 1995; Ferguson & Ladd, 1996; Goldhaber & Anthony, 2004; Rivken et al., 2005; Wright et al., 1997. For studies relating to Mexico, see Luschei, 2005; Santibañez, 2002.) Based on the growing literature which holds that teacher ability, say in mathematics, influences student mathematics learning, the capacity of education systems to recruit individuals with higher mathematics abilities into teaching should result in better average performance in mathematics.

If higher relative salaries for teachers do attract individuals with higher ability into teaching, then it seems likely that in those countries with more unequal income distributions and with high premiums for mathematics ability, it will be relatively more costly to convince higher ability people to enter teaching. This premise assumes, of course, that higher teacher pay does increase the recruitment of teachers with higher ability. While this assumption is crucial to our premise, it is also controversial, at least among educational economists.

When we regressed the teacher salary ratios for men and women on the Gini coefficients for each country (see Table 8), we found a negative relationship between male teacher salary ratio and income inequality (as we had expected) and a negative relationship between the female teacher salary ratio and the Gini. However, neither of these relationships was statistically different from zero (Table 9). When we controlled for GDP per capita, the results did not change appreciably. The relative salaries paid to teachers, therefore, do not appear to relate to income distribution, a finding that counters our hypothesis.

One reason why relative teacher salaries may not relate to overall income distribution is that the salaries of university graduates are generally found in the upper-20%-income bracket in most societies, and in an even higher bracket in lower-income societies. So, although, in most countries, the Gini coefficient does a particularly good job of capturing changes at the upper end of the distribution, it and other measures of income distribution mainly capture differences between how much professionals *as a group* earn and how much less-educated wage-workers *as a group* earn in lower-paying occupations. The Gini thus does not do well in capturing the *differences among the salaries* of various kinds of professionals.

Because the ratio of teacher salaries to the salaries of mathematics-oriented professions is apparently unrelated to the variation in income distribution (or GDP per capita) across countries, it is likely that this ratio is a function of some variable that we have not measured. This could be, for example, the value that the society places on education, the strength of teachers' unions, or even how much mathematics learning those who enter teaching have experienced relative to those working as scientists and engineers.

Some of these explanations are difficult to unravel. For example, a society may place a high value on education and pay teachers relatively high salaries. In such a case, the teaching profession is more likely to attract individuals with mathematics skills that are similar to those in mathematics-oriented professions. We can put this another way: when mathematics teachers are paid more equally than people engaged in other work requiring high mathematics skills, graduates are more likely to choose whether to become teachers according to how how they want to use their mathematics skills rather than according to economic considerations. We would need to go into a long history of the teaching profession to understand if mathematics skills preceded high relative salaries, or vice versa. Even if strong teachers' unions were the explanation for higher relative salaries, this situation could be one that attracts individuals with higher

Table 8: Gini Coefficients for Case Study Countries, by Country, 1990 to 2001

Country	Income Distribution (Gini coefficient x100)		
	1990	*1995*	*Latest Year*
Australia	41.7	35.0 (1994)	
Botswana	54.2 (1986)		
Bulgaria	24.5	34.4 (1993)	32.0 (2001)
Chile	57.9	56.5 (1994)	58.0 (2000)
Chinese Taipei	30.1	30.8	
Finland	26.1		27.0 (2000)
France	34.9	33.0	
Germany	32.2		28.0 (2000)
Hong Kong SAR	45.0	43.0 (1996)	
Italy	32.2		36.0 (2000)
Korea	33.6		32.0 (1998)
Mexico	50.3		55.0 (2000)
Norway	33.3		26.0 (2000)
Philippines	41.0	43.0 (1994)	46.0 (2000)
Singapore	40.0		42.0 (1998)
Spain	28.0		35.0 (2000)
Switzerland			34.0 (2000)
Thailand	48.8	43.0 (1996)	42.0 (2002)
United Kingdom	32.3		36.0 (1999)
United States	37.8		41.0 (2000)

Source: 1990 and 1995—Deininger and Squire (1996); latest year—World Bank (2005); world development indicators—http://devdata.worldbank.org/dataonline/.

Table 9: Estimated Relationship between Relative Teacher Salaries, Income Distribution, and GDP per Capita in 20 Countries, Early 2000s

Variable	Male Teacher Salary/Scientist Salary		Female Teacher Salary/Scientist Salary	
Gini Coefficient	-0.284 (-0.62)	0.130 (0.24)	0.255 (0.70)	0.508 (1.14)
GDP per Capita		6.70×10^{-6} (1.30)		4.07×10^{-6} (0.98)
Intercept	0.943***	0.649**	0.806***	0.626**
F-value	0.38	1.04	0.49	0.72
N	20	20	20	20
Adjusted R^2	-0.034	0.004	-0.027	-0.030

Note: **Statistically significant at 5% level of significance; ***statistically significant at 1% level.
Source: Table 34, *t*-values in parentheses.

mathematics skills into the profession. But again, without a historical events analysis, it is difficult to determine if the high mathematics skills were there before union impact or if the high mathematics skills were the result of unions raising salaries and attracting highly skilled individuals into teaching.

Keeping these complexities in mind, we estimated the relationship between the teacher/scientist salary ratio and student performance on the mathematics portion of the TIMSS and PISA tests. All of the countries for which we estimated relative teacher salaries had participated in TIMSS 2003 or PISA 2003. We first needed to estimate a TIMSS score and a PISA score for each of the 20 countries in our sample that participated in one or other of the tests. Fourteen of the 20 countries participated in TIMSS and 11 in PISA. In total, 17 countries in the world (including many not in our sample) participated in both tests that year. From those 17 scores, we estimated a relationship between the scores and used that relationship to estimate TIMSS scores for those countries in our sample where students sat the PISA but not the TIMSS test. We also used the relationship to estimate PISA scores for those countries in which the students sat the TIMSS test but not the PISA.[6] Table 10 shows the average scores of students in each country in our sample. The imputed TIMSS and PISA scores for 2003 are indicated in bold font.

Table 10: TIMSS and PISA Mathematics Scores, by Country, 2003

Country	TIMSS Mathematics Scores	PISA Mathematics Scores
Australia	505	524
Botswana	366	**358**
Bulgaria	476	**460**
Chile	387	**377**
Chinese Taipei	585	**562**
Finland	**551**	544
France	**525**	511
Germany	**518**	503
Hong Kong SAR	586	550
Italy	484	466
Korea	589	542
Mexico	**424**	385
Philippines	378	**369**
Singapore	605	**581**
Spain	**504**	485
Switzerland	**537**	527
Thailand	**450**	417
United Kingdom	498	**481**
United States	504	483

Source: TIMSS—Mullis, Martin, Gonzalez, and Chrostowski (2004).

6 The estimated relationships were as follows:

- TIMSS mathematics score = 117.5 + 0.797; PISA mathematics score + e (adjusted $R^2 = 0.73$);
- PISA mathematics score = 16.8 + 0.932; TIMSS mathematics score + e (adjusted $R^2 = 0.73$).

When we developed estimates for the 1999 TIMSS score compared to the 2000 PISA score, based on the 22 countries that took both tests in those years, we found very similar results, although R^2 (0.70) was slightly lower.

Table 11 presents the results of our regression of the TIMSS and the PISA mathematics scores on relative teacher salaries, GDP per capita, and income distribution for the 20 countries in our sample. Male salary ratios correlated significantly and positively with student 2003 mathematics test scores, but female salary ratios did not. A 10% increase in the ratio of male teacher salaries to male scientist salaries was associated with a 14% increase in the TIMSS mathematics score and a 10% to 11% increase in the PISA mathematics score. The relationship between female teacher salary ratio and student test score was not statistically significant, and the coefficient was smaller.

We also estimated a model in which we added the secondary school net enrollment ratio in each country in order to "correct" for the possibility that student achievement scores in some countries were higher because a smaller proportion of the age cohort was in secondary school to take the test, making for a more select group of students and thereby biasing the achievement scores upward. However, including the net enrollment ratio had almost no effect on the regression results, largely because of the strong correlation between net secondary enrollment ratio and GDP per capita.

The results in Table 11 suggest that even when we control for other factors that we know relate to higher test scores, students in countries where teachers are paid more relative to males' salaries in competing professions do better on mathematics knowledge tests. Nevertheless, we have to be careful in interpreting this finding as a causal relationship: higher relative teacher salaries may attract teachers with greater mathematics skills, and these greater mathematics skills may result in more mathematics learning for students. However, as we discussed earlier, another argument is that countries that value high mathematics skills in students end up paying teachers more in order to recruit teachers with higher mathematics skills, and hence increase the probability that students learn mathematics well. Also, countries that are willing and able to recruit teachers with higher levels of mathematics skills into teaching are more likely to develop a demanding

Table 11: Estimated Relationship between Student Performance on TIMSS and PISA Mathematics Tests and Teachers' Salaries Relative to Scientists' Salaries, Early 2000s (t-values in parentheses)

Independent Variable	Outcome Variable							
	TIMSS Mathematics Score				*PISA Mathematics Score*			
	Model I	*Model II*	*Model III*	*Model IV*	*Model I*	*Model II*	*Model III*	*Model IV*
Male Teacher Salary Ratio	135.0* (1.81)	143.2** (2.11)			101.5 (1.57)	109.9* (1.98)		
Female Teacher Salary Ratio			71.4 (0.74)	123.3 (1.37)			41.4 (0.50)	93.0 (1.28)
GDP per Capita	0.004** (2.57)	0.002 (1.13)	0.004*** (3.03)	0.002 (1.35)	0.004*** (3.61)	0.002* (1.97)	0.005*** (4.05)	0.003** (2.14)
Gini Coefficient x 100		-3.27** (-2.10)		-3.74** (-2.18)		-3.36** (-2.64)		-3.71** (-2.66)
Intercept	313.3***	468.5***	347.1***	486.2***	309.7***	469.0***	345.8**	483.8***
Adjusted R^2	0.40	0.50	0.30	0.43	0.51	0.64	0.44	0.59
N	20	20	20	20	20	20	20	20

Note: *Statistically significant at 10% level of significance; **statistically significant at 5% level; ***statistically significant at 1% level.

Source: Table 34 and Table 36, *t*-values in parentheses.

mathematics curriculum that provides their students at all levels of schooling with greater opportunity to learn.

But it is also possible that societies in which students score highly in mathematics are those societies with a large labor pool of mathematics skills. The teachers drawn from that labor pool are likely to be as adept in mathematics as are other university-educated professionals. They are also likely to be paid about the same as professionals in other mathematics-oriented occupations. This situation undermines the argument that the causality moves from the higher relative salaries for teachers to the higher mathematics scores for students. Rather, the higher student mathematics scores may indicate the existence of a relatively high level of mathematics knowledge in the society, which means that teachers and other mathematics professional salaries are therefore similar. Here, the fact that teachers have sufficient alternative employment possibilities available to them means that the government must pay them salaries similar to those of individuals in other mathematics-oriented professions in order to recruit them into teaching.

Knowing what we know about how societies set teacher pay, the argument that higher relative teacher salaries are more likely to attract people with higher mathematics skills into teaching seems more logical to us than the argument that when teachers have better mathematics skills, they are more likely to receive salary offers commensurate with offers in other mathematics-oriented occupations. However, this latter argument cannot be ruled out as an "explanation" for our regression results.

One of the mysteries to emerge from our analysis is why the relative salaries of females are less closely related with student performance than are the relative salaries of males. We think this is a result of a separate dynamic in most societies related to how well women are paid relative to men. As is the case with teachers' relative salaries, this situation is a function of social norms that, in turn, are affected by political conditions, social movements, and so on.

One possible explanation for the weaker relationship between females' relative salaries and students' mathematics test scores may be that in societies with greater income differences between men and women, salaries for female teachers are akin to salaries for female scientists. However, there appears to be little relationship in our sample between the ratio of male to female scientists' salaries and female teachers' salaries. Men and women tend to be paid essentially equal salaries in teaching. However, in many societies, the salaries paid to men and women working in other professions differ substantially. Therefore, the ratio of male teachers' salaries to male scientists' salaries may be a better reflection than the female teacher salary ratio of how much societies value education, and thus how well children in the society are likely to do in mathematics (and possibly reading).

Confirmation of this premise would then suggest that relative salaries are less a measure of attracting high mathematics skills into teaching (although we found that the sign of the coefficient of the female teacher salary ratio was also positive and the coefficient almost as large as that for the male teacher salary ratio) than a measure of the willingness of a society to pay for a good education. This willingness to pay would likely also relate to the emphasis that parents at home place on good education, to pressure on children to do well, and so forth. If this scenario is valid, raising teacher relative salaries may attract a "better" teacher into schools to teach mathematics, but it would be difficult to raise teachers' salaries in a society that does not already place considerable emphasis on its children doing well in school.

Whatever the explanation, higher relative teacher salaries are associated with higher test scores, even when we control for other important factors associated with those higher test scores. Because our sample of countries was small, more work is needed to test whether this is a policy variable or just an indicator of something else that explains high test scores and that correlates with the ratio of teacher salaries relative to the salaries of other professions.

An additional caveat is that raising teacher salaries across the board (for all teachers in the teacher labor force) in those countries with relatively low teacher salaries is an expensive policy option. A much cheaper option is to raise the salaries only of starting teachers or only of teachers with skills in short supply, such as mathematics and science. However, these alternatives may face opposition from teachers' unions. And, as we have mentioned, any salary-increase policy involves many unknowns, such as the response rate of higher ability individuals to higher salaries in teaching. A number of analysts have argued that more spending per student on education does not produce higher student test scores (see, for example, Hanushek et al., 1994). Although the empirical foundations of this argument are highly problematic (see, for example, Rothstein & Miles, 1995), there is enough of a case against simply raising teacher salaries as a policy tool in order to improve schooling outcomes to create considerable political resistance to it.

Nevertheless, the underlying notion that societies that seriously want to improve their students' performance in school must improve the quality of teachers in schools is also compelling. It is difficult to determine how that improvement could be made other than to raise the bar that indicates the level of skills individuals must have to enter teaching. But if the bar is raised, it is also difficult to conceive of a means of attracting individuals into teaching with those high skills other than that of making teacher remuneration competitive with the remuneration offered in other professions requiring a similar level of academic skills.

References

Allegretto, S. A., Corcoran, S. P., & Mishel, L. (2004). *How does teacher pay compare? Methodological challenges and answers.* Washington, DC: Economic Policy Institute.

Carnoy, M., Gove, A., & Marshall, J. (2007). *Cuba's academic advantage.* Palo Alto, CA: Stanford University Press.

Carnoy, M., Marshall, J., & Socias, M. (2003). *How do school inputs influence math scores? A comparative approach.* Standford, CA: Stanford School of Education (mimeo).

Chiu, M. M., & and Khoo, L. (2005). Effects of resources, inequality, and privilege bias on achievement: Country, school, and student level analyses. *American Educational Research Journal, 42*(4), 575–603.

Clotfelter, C., Ladd, H., & Vigdor, J. (2007). *How and why do teachers matter for student achievement?* (Working paper 12828). Cambridge, MA: National Bureau of Economic Research.

Corcoran, S., Evans, W. N., & Schwab, R. S. (2002). *Changing labor market opportunities for women and the quality of teachers, 1957–1992* (National Bureau of Economic Research Working Paper 9180). Available online at http://www.nber.org/papers/w9180.

Deininger, K., & Squire, L. (1996). A new data set measuring income inequality. *World Bank Economic Review, 10*(3), 565–591.

Ehrenberg, R., & Brewer, D. (1995). Did teachers' verbal ability and race matter in the 1960s? Coleman revisited. *Economics of Education Review, 14*(1), 1–21.

Ferguson, R., & Ladd, H. (1996). How and why money matters: An analysis of Alabama schools. In H. Ladd (Ed.), *Holding schools accountable: Performance-based reform in education* (pp. 265–298). Washington, DC: Brookings Institution Press.

Goldhaber, D., & Anthony, E. (2004). Can teacher quality be effectively assessed? Washington, DC: The Urban Institute.

Hanushek, E. A. (2006). Teacher compensation. In P. Peterson (Ed.), *Reforming education in Florida* (pp. 149–163). Stanford, CA: Hoover Institution Press.

Hanushek, E. A., with Benson, C. S., Freeman, R. B., Jamison, D. T., Levin, H. M., Maynard, R. A., Murname, R. J., Rivkin, S. G., Sabot, R. H., Solmon, L. C., Summers, A. A., Welch, F., & Wolfe, B. L. (1994). *Making schools work: Improving performance and controlling costs.* Washington, DC: Brookings Institution.

Lavy, V. (2005). *Performance pay and teachers' effort, productivity and grading ethics.* Jerusalem: Hebrew University.

Luschei, T. F. (2005). *In search of good teachers: Patterns of teacher quality in two Mexican states.* Unpublished doctoral dissertation, Stanford University School of Education, Stanford, CA.

Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., & Chrostowski, S. J. (2004). *TIMSS international mathematics report.* Chestnut Hill, MA: Boston College.

Organisation for Economic Co-operation and Development (OECD). (2003). *Reviews of national policies for education: Chile.* Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2004a). *Education at a glance: Education indicators 2004.* Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2004b). *Learning for tomorrow's world.* Paris: Author.

Rivkin, S. G., Hanushek, E., & Kain, J. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417–458.

Rothstein, R., & Miles, K. H. (1995). *Where has all the money gone?* Washington, DC: Economic Policy Institute.

Santibanez, L. (2002). *Why we should care if teachers get As? Impact on student achievement in Mexico.* Unpublished doctoral dissertation, School of Education, Stanford University, Stanford, CA.

Schmidt, W. H., McKnight, C. C., Houang, R. T., Wang, H. C., Wiley, D. E., Leland, S. C., & Wolfe, R. G. (2002). *Why schools matter: A cross-national comparison of curriculum and learning.* San Francisco, CA: Jossey-Bass.

Schmidt, W. H., Tatto, M. M., Bankov, K., Blömeke, S. Cedillo, T., Cogan, L., Han, S. I., Houang, R., Hsieh, F. J., Paine, L., Santillan, M., & Schwille, J. (2008). *The preparation gap: Teacher education for middle school mathematics in six countries* (MD21 report). East Lansing, MI: Michigan State University.

Vidal, R., & Diaz, M. A. (2004). *Resultados de las Pruebas PISA 2000 y 2003 en Mexico (Results of the 2000 and 2003 PISA Tests in Mexico).* Mexico: Interagency Network for Education in Emergencies (INEE).

Willms, J. D. (2003). *PISA 2000: Socioeconomic status and reading performance of French- and Italian-speaking Swiss students.* Retrieved July 31, 2007, from https://auxweb.unb.ca/applications/crisp/pdf/0303.pdf.

World Bank. (2005). *World development indicators.* Available online at http://devdata.worldbank.org/dataonline.

Wright, S. P., Horn, S., & Sanders, W. L. (1997). Teacher and classroom context effects on student achievement: Implications for teacher evaluation. *Journal of Personnel Evaluation in Education, 11*(1), 57–67.

PART 2

INDIVIDUAL COUNTRY STUDIES

Australia

Composition of the teacher labor force

In 2004, Australia employed a total of 265,919 teachers (233,065 equivalent full-time teachers), the majority of whom were female (Australian Bureau of Statistics (ABS), 2005). Over the last two decades, the percentage of female teachers has increased. In 2002, 79% of primary school teachers were female compared to 70% in 1982. The corresponding figures for secondary school teachers were 55% and 44%. In 2002, 80% of teachers 30 years of age and under were female. Even so, there tends to be more male than female secondary school teachers of mathematics.

Australia's teaching force is also getting older: the median age of teachers increased from 34 to 43 years between 1986 and 2001. Although the age distribution varies across different regions, 44% of all teachers are 45 years of age and over. The nation's teacher composition will change even more as teachers approach retirement age. A number of teachers are already taking early retirement, and a large portion of the teaching force may retire in the next 5 to 10 years. Teacher retirements could very well affect secondary mathematics and science fields disproportionately, particularly if, as indicated by some sources, mathematics teachers are older, on average, than teachers in other fields.

Australia's moderately strong economic growth from 2002 to 2008 may have further encouraged teachers to resign from teaching and move into other occupations. Webster, Wooden, and Marks (2004) looked at ABS labor mobility survey data from 1998 to 2002 and found that inflows and outflows occur primarily between teaching and non-work sectors, instead of between teaching and outside jobs. Also, secondary-level teachers are slightly more likely than primary-level teachers to shift to and from other labor markets. However, the current recession may have the opposite effect, making it easier to bring young people back into more secure professions such as teaching and nursing that have experienced staffing downturns in recent years.

The number of students graduating from teaching education institutions declined during 1996 to 1999 but then increased between 2000 and 2001. Entrants into teacher education programs at this time were most likely to be from the middle of the national income distribution than from the extremes, and they tended to have been raised in provincial cities or rural regions rather than in urban areas. On graduating, these individuals comprised 70% of the new supply of teachers. One-third of those who received a teaching degree elected to work outside of education (Webster et al., 2004).

Leigh and Ryan (2006) found that between 1983 and 2003, the quality of new teachers, as measured by ninth grade literacy and numeracy scores, fell significantly. They attributed this change partially to the fact that the average salary for teachers declined significantly compared to salaries received by non-teachers with a degree. The authors also posited that a greater increase in the upward deciles of the wage distribution for non-teachers has made teaching less attractive in the 2000s as compared to earlier decades.

There has been considerable concern about the future availability of quality mathematics, science, and technology teachers who can maintain or improve the high performance of students over time. Webster et al. (2004, 2005) provide evidence of persistent shortages of qualified mathematics and science teachers in Australia, especially in secondary school physics, chemistry, mathematics, and technology-related subject areas. They

argue that rigid pay scales contribute significantly to this problem. They also maintain that higher wages for mathematics and science teachers could attract graduates and reduce attrition.

The rural areas of Australia, in particular, experience difficulty finding English, mathematics, and other subject-area teachers. At the end of 2000, only 3,000 teachers were registered as unemployed, and forecasts estimate that there could be shortages of up to 20,000 to 30,000 teachers by the end of this decade. Secondary schools will be more hard pressed in this regard than primary schools, as will mathematics, science, and technology subject areas.

Teacher recruitment, hiring, and education

Teacher acceptance and hiring varies greatly across the states and territories of Australia. In most places, teachers must initially undergo a one-year probationary period, after which they are generally evaluated by school leaders and subsequently hired or rejected.

In addition to the diversity of recruitment policies across different regions, Australia has a large proportion of private schools that often have their own rules and practices. In 2001, 67.1% of primary school teachers and 62.4% of secondary-level teachers were working in public schools; 30.4% and 34.7% of primary- and secondary-level teachers were working in private schools (Webster et al., 2004). Both categories had a large proportion of full- or part-time permanent teachers, but both had also seen a rise in the number of contracted teachers over the years.

Teacher education programs in Australia are widespread and diverse. In 2001, 38 institutions were conducting 296 different teacher education programs for prospective primary and secondary teachers. Some states and territories produce more secondary teachers, while others produce more primary teachers, a product, perhaps, of the relative composition of student populations.

In Australia, teacher education programs generally provide flexible options for prospective teachers, such as four-year degrees, three-year degrees plus one year of postgraduate studies, or concurrent joint degrees. Most students receive either a four-year Bachelor of Education teaching degree or a Bachelor's degree in a non-education area along with a subsequent one- or two-year teacher education degree. Individual universities generally decide their own admission levels, with acceptance primarily based on the individual student's academic background.

From 1994 to 2002, the number of new students in teacher education rose from 14,000 to 21,000, not only because of an expansion in primary teacher education but also because more people completed teacher education programs in general. During that period, however, only 60% of teacher education graduates began working full-time within a year of leaving their program. Recently, greater attention has been given to attracting working professionals into teaching as a second career.

In 2001, 48% of teacher education graduates possessed three- or four-year undergraduate degrees, 40% possessed graduate degrees, and 12% had double degrees. Sixty-three percent of the graduates of the three- or four-year programs entered primary and early childhood education, while 63% of those with advanced degrees went into secondary education (Ballantyne, Bain, & Preston, 2003). Of the recent graduates entering

secondary education, 16.2% specialized in physics, chemistry, or mathematics, and 4% specialized in information and communication technology (ICT). Of the graduates with Master's degrees entering secondary education, an even higher proportion specialized in chemistry, physics, or mathematics (Ballantyne et al., 2003).

Over the last two decades, fewer mathematics and science graduates have entered teacher education programs or teaching directly. A 2003 report published by the Ministerial Council on Employment, Education, Training, and Youth Affairs (MCEETYA) noted that only six percent of mathematics degree holders, six percent of life science degree holders, and three percent of physical science degree holders entered teacher education programs or the teaching profession. In 1998/1999, 61% of Grade 8 mathematics classes were being taught by teachers with a degree major in mathematics, and 72% of Grade 8 mathematics classes were being taught by teachers with a major in either mathematics or mathematics education. During the same period, 70% of Grade 12 mathematics teachers and 80% of Grade 12 science teachers had a three-year or beyond mathematics or science degree, respectively.

Teacher salaries

Average teacher salaries in Australia for new teachers and teachers with 15 years of experience are close to the means for the OECD countries. Salary distributions vary across the states and territories, however. Australian teachers tend to reach the summit of the salary scale (140% of the starting salary) after about 8 to 11 years. The starting salaries of teachers are generally higher than those of other professionals, but the shortened salary schedule for teachers means that teachers reach their maximum salary band more quickly than other professionals reach theirs.

By referring to ABS employee salary and hours data for 2000, and on the assumption that teachers have only four weeks of annual leave, in line with the leave complements of other occupations, Webster and colleagues (2004) found that teachers and other professionals have the same average hourly wage rate of $AU25.00. However, on taking the leave complement as 12 weeks, the researchers found that teachers had a 20% higher hourly wage rate, and that their wages were exceeded only by IT professionals. Webster et al. (2004) additionally controlled for age, experience, education level, and other background and job-related characteristics, and found that teachers' salaries were somewhat below those of other professionals.

Data from the 2001 Census of Population and Housing (ABS, 2001) showed teachers earning more than the average worker per week ($AU897 versus $AU799). The census also reported secondary school teachers earning more than elementary school teachers per week ($AU956 versus $AU841). Male teachers generally were earning more than their female counterparts: the average weekly salary of a male secondary school teacher at the time was $AU1,038 compared to $AU878.

A 2003 report by the Committee for the Review of Teaching and Teacher Education noted that the starting salaries of recent teacher education graduates exceeded those of average graduates. As expected, holders of dentistry, medicine, optometry, engineering, law, computer science, and mathematics degrees had higher starting salaries, while graduates with earth, physical, and biological science majors had slightly lower starting salaries.

Tables 12 and 13 show that the mean weekly incomes for male teachers in both 1996 and 2001 were considerably below the mean weekly incomes for males in other mathematics- and science-oriented occupations and, indeed, in all other occupations employing males with Bachelor's degrees.[7] The difference between the occupational sets was somewhat smaller in 2001 than in 1996. There was very little difference across both years in terms of whether the individuals held a Bachelor's degree or a postgraduate degree. The mean weekly incomes of female teachers were also lower than the mean weekly incomes for females in other mathematics/science professions in both years, but female teachers with a Bachelor's degree earned more than females with a Bachelor's degree working in other professions.

Teachers with postgraduate degrees earned lower weekly incomes than both mathematics and science professionals and females in other professions. This situation was evident in both 1996 and 2001. A female teacher with a Bachelor's degree, 30 to 34 years of age, earned about one-third less than a female of the same age with a Bachelor's degree in a mathematics/science profession in both 1996 and 2001. Although this difference varied somewhat for different ages and for different levels of education, these teachers received lower rates of pay than their counterparts in mathematics and science professions, and the difference was fairly large.

The data on median incomes presented in Figures 2 to 5 confirm these patterns.

Table 12: Australia, Mean Weekly Earnings of Males and Females in Mathematics/Science Occupations and Teaching, by Level of Education and Age, 1996

	Males with Bachelor's Degree, 1996			Females with Bachelor's Degree, 1996		
Age	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*
20–24	650	524	506	607	516	475
25–29	851	647	741	772	612	630
30–34	1,015	767	916	838	647	665
35–44	1,065	833	991	816	675	652
45–54	1,077	858	1,025	823	746	678
55–64	993	793	952	734	734	629
	Males with Postgraduate Degree, 1996			Females with Postgraduate Degree, 1996		
Age	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*
20–24	622	548	503	613	541	479
25–29	826	639	728	734	592	625
30–34	997	742	896	835	635	680
35–44	1,054	824	974	844	668	676
45–54	1,050	848	997	839	740	720
55–64	984	795	917	842	686	657

Source: Australian Bureau of Statistics (1996). Income variable indicates the gross income (including pensions and allowances) that the person usually receives each week. Applicable to persons aged 15 years and over.

7 The most recent census survey is for 2006, but this information was not available in late 2006 when we made these estimates. We expect, however, that little change in relative incomes occurred between 2001 and 2006.

Table 13: Australia, Mean Weekly Earnings of Males and Females in Mathematics/Science Occupations and Teaching, by Level of Education and Age, 2001

	Males with Bachelor's Degree, 2001			Females with Bachelor's Degree, 2001		
Age	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*
20–24	811	685	599	745	669	570
25–29	1,042	811	889	949	754	781
30–34	1,182	976	1,051	993	794	816
35–44	1,225	1,068	1,112	977	842	777
45–54	1,220	1,104	1,121	997	952	803
55–64	1,135	1,008	1,056	933	904	739
	Males with Postgraduate Degree, 2001			Females with Postgraduate Degree, 2001		
Age	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*
20–24	797	709	589	783	692	590
25–29	1,034	802	918	967	755	813
30–34	1,181	944	1,076	1,022	790	848
35–44	1,221	1,044	1,140	1,011	827	841
45–54	1,217	1,094	1,137	1,042	946	880
55–64	1,141	1,002	1,024	925	886	793

Source: Australian Bureau of Statistics (2001). Income variable indicates the gross income (including pensions and allowances) that the person usually receives each week. Applicable to persons aged 15 years and over.

Figure 2: Australia, Age-Median Earnings of Males with Bachelor's Degree, 1996

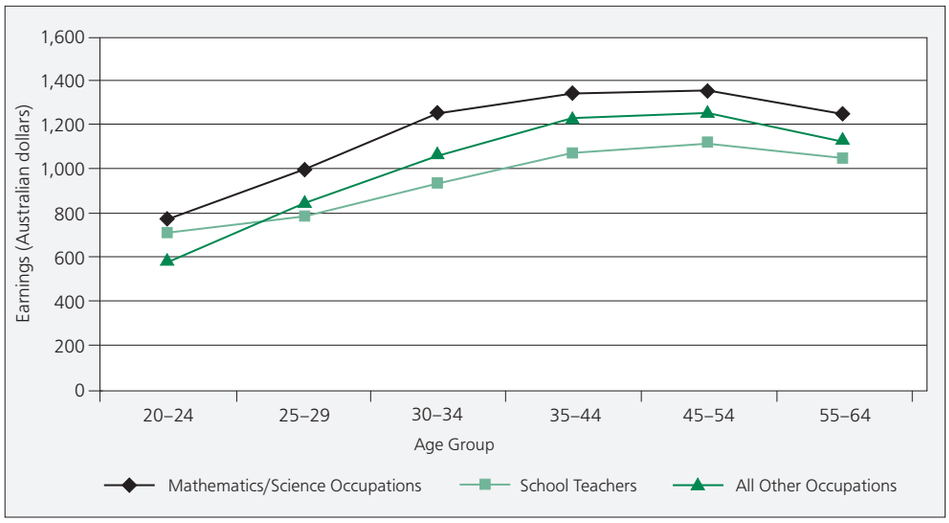


Figure 3: Australia, Age-Median Earnings of Females with Bachelor's Degree, 1996

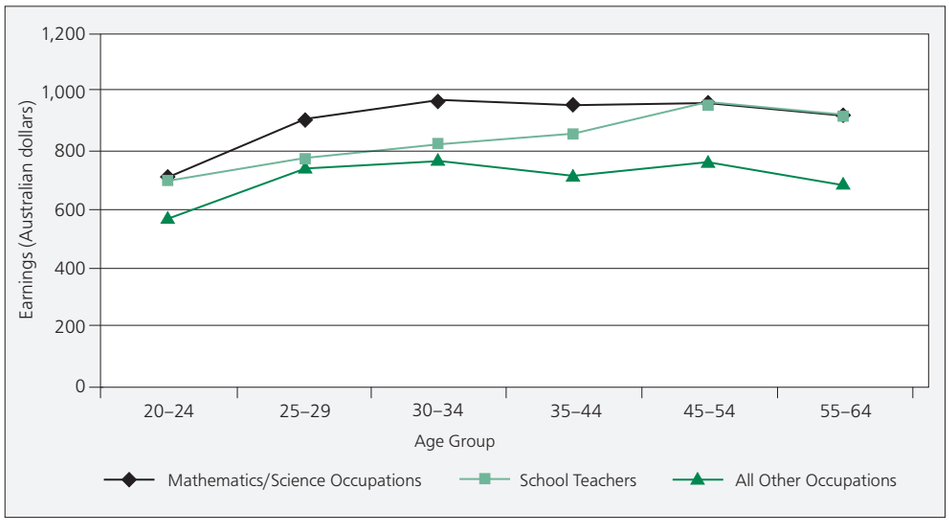


Figure 4: Australia, Age-Median Earnings of Males with Bachelor's Degree, 2001

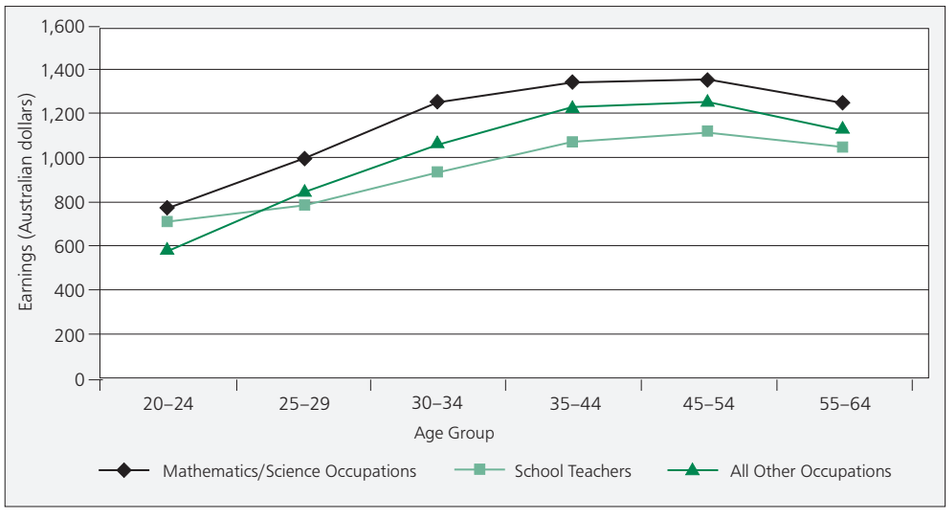
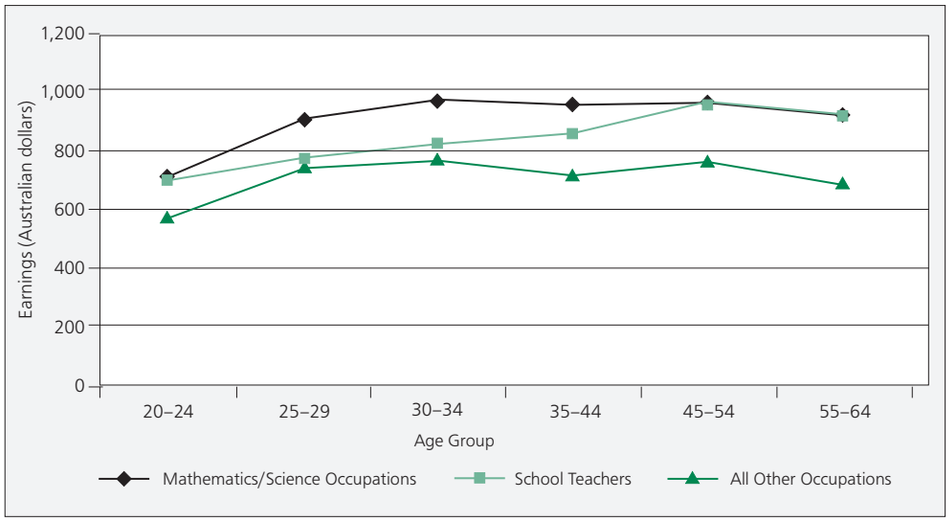


Figure 5: Australia, Age-Median Earnings of Females with Bachelor's Degree, 2001



References

Australian Bureau of Statistics. (1996). *Census of population and housing, 1996*. Retrieved May 24, 2009, from http://www.abs.gov.au/Census.

Australian Bureau of Statistics. (2001). *Census of population and housing, 2001*. Retrieved May 24, 2009, from http://www.abs.gov.au/Census.

Australian Bureau of Statistics. (2005). *Schools, Australia, 2004* (Category number 4221.0., Table 64). Canberra, ACT: Author.

Ballantyne, R., Bain, J. D., & Preston, B. (2003). *Teacher education courses and completions: Initial teacher education courses and 1999, 2000, 2001 completions*. Canberra, ACT: Department of Education, Science, and Training (DEST).

Committee for the Review of Teaching and Teacher Education. (2003). A*ustralia's teachers, Australia's future: Advancing innovation, science, technology and mathematics, background data, and analysis*. Canberra, ACT: Department of Education, Science and Training (DEST).

Leigh, A., & Ryan, C. (2006). *How and why has teacher quality changed in Australia?* Canberra, ACT: Centre for Economic Policy Research, the Australian National University.

Ministerial Council on Employment, Education, Training, and Youth Affairs (MCEETYA)/ Teacher Quality and Educational Leadership Taskforce. (2003). *Demand and supply of primary and secondary teachers in Australia*. Canberra, ACT: Department of Education, Science, and Training.

Webster, E., Wooden, M., & Marks, G. (2004). *Reforming the labour market for Australian teachers*. Melbourne, VIC: Melbourne Institute of Applied Economic and Social Research, University of Melbourne and Australian Council for Educational Research.

Webster, E., Wooden, M., & Marks, G. (2005). Teaching and the teacher labour market: The case for reform. *The Australian Economic Review, 38*(1), pp. 91–98.

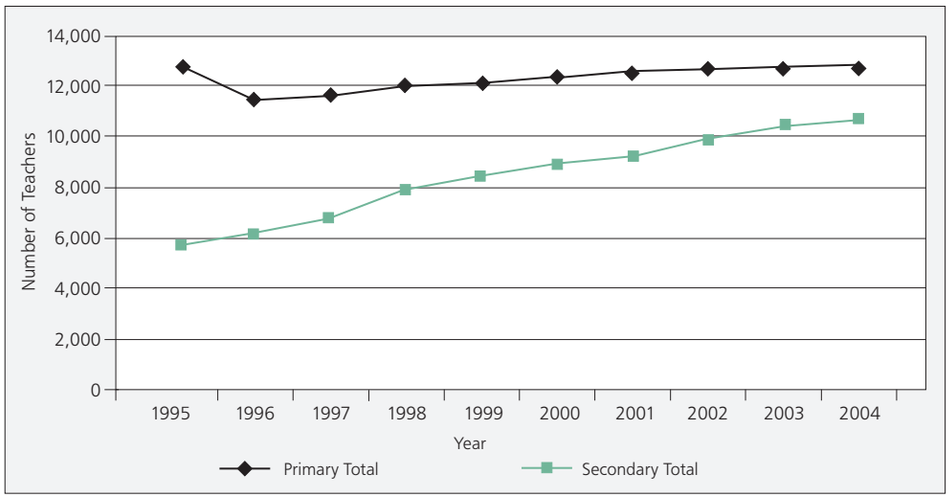
Botswana[8]

Composition of the teacher labor force

In the early 2000s, Botswana had almost 13,000 primary school teachers (Figure 6) for about 330,000 primary school students, or a student–teacher ratio of 26:1. The number of primary teachers and the number of primary students barely changed from 1998 on. Primary teaching is largely a female profession; approximately 80% of the teaching workforce is female. Close to 95% of teachers are Batswana, but the proportion of non-Batswana has risen slowly, from four percent in 1995 to six percent in 2004. Although the proportion of "untrained" primary school teachers in Botswana fluctuates from year to year, the percentage in the early 2000s hovered around 10%.

The number of secondary school teachers doubled in the 10 years following 1995 (Figure 6). The number of secondary school students increased by 50% in the same period, from 103,000 to almost 159,000. Thus, the student–teacher ratio declined substantially in secondary education, from more than 20:1 to 15:1. Another major change that occurred in the 10 years following 1995 was the proportion of teachers identifying as Batswana or non-Batswana: in 1995, more than 30% of secondary school were non-Batswana; by 2004, the proportion had dropped to 14%, suggesting that the main expansion of secondary education occurs in government and government-aided schools where the teaching force is primarily Batswana. Most of the expansion took place in grant-aided schools rather than in schools run directly by the government. Untrained teachers declined as a percentage of all secondary school teachers, from 15% in 1995 to 6% in 2004.

Figure 6: Botswana, Number of Primary and Secondary Teachers, 1995 to 2004



Source: Central Statistics Bureau, Botswana.

8 Unless otherwise specified, data for Botswana were drawn from these websites: http://www.moe.gov.bw/tsm/about/structure.html; http://www.ei-ie.org/en/news/show.php?id=5&theme=rights&country=botswana; http://www.moe.gov.bw/information/index.html.

Teacher education

All teachers at the primary level are required to have a Diploma in Primary Education.[9] The diploma program takes three years to complete. Eligibility for the program, and thereby eligibility for primary teacher education, rests on applicants having completed the Cambridge Overseas School Certificate (COSC) ordinary level or the Botswana General Certificate of Secondary Education (BGCSE). The diploma is offered at four colleges of education (Francistown, Lobatse, Serowe, and Tlokweng). These colleges are under direct control of the government and graduate about 400 teachers annually; around 60% of them are women.

Students working toward the Diploma in Primary Education are required to take all the subjects in the primary school curriculum. They are also required to select an area of specialization from one of the following combinations: (i) mathematics and science; (ii) English and Setswana; (iii) social studies and religious education; and (iv) practical subjects (any two from agriculture, arts and crafts, home economics, music, and physical education).

Individuals who do not have the Diploma in Primary Education must take an upgrading course to acquire it. This course is offered by the Centre for Continuing Education at the University of Botswana in the form of a distance-learning program. Teachers who hold the Primary Teaching Certificate (PTC) also have to take the upgrading course, as the PTC has been phased out.

As of 2002, the proportion of untrained primary school teachers was 9.3%; by 2004, this proportion had dropped to 7.5%.

All secondary school teachers, if they are citizens, must have at least a Diploma in Secondary Education. They must have a Bachelor's degree in education if they are non-citizens. Secondary school teachers teach the subjects they train in, unlike their colleagues at the primary level, who are required to teach all subjects. The Diploma in Secondary Education also takes three years to complete. The qualifications for entry into junior secondary teacher education are the COSC or the BGCSE with specified credits. The Diploma in Secondary Education is currently offered by two colleges of education—Tonota and Molepolole. Together, the colleges graduate about 400 teachers annually.

The subjects offered in both colleges are English, guidance and counseling, library studies, moral education, religious education, Setswana, science, and social studies. The College of Education at Tonota also offers agriculture, home economics, business studies, and physical education. Art, design and technology, music, and computer education are the province of the College of Education at Molepolole.

An addition to the above programs is the University of Botswana's Bachelor of Education (BEd), with specialization in primary teaching or in secondary teaching. The university also offers a one-year postgraduate diploma in education for graduates from general degree programs (BSc and BA) who qualify to teach in secondary schools. Secondary school teachers who have at least six years of teaching experience are eligible to attend staff development programs at the colleges of education.

9 Botswana operates a 2–7–3–2 structured pre-tertiary education system, with two years of pre-primary education (for children 4 to 5 years of age), seven years of primary (6 to 12 years), three years of junior secondary (13 to 15 years), and two years of senior secondary (16 to 17 years).

As of 2002, 6.7% of teachers at the community junior secondary level were untrained. Although a corresponding figure for the senior secondary level is not available, the number of trained teachers in junior and senior secondary schools doubled between 1995 and 2004—to almost 10,000 teachers. Only six percent of these teachers were untrained.

Teacher recruitment and hiring

Teacher recruitment and hiring is highly centralized in Botswana, with the Department of Teaching Service Management (TSM) within the Ministry of Education responsible for teacher employment in the country. TSM manages the recruitment of teachers for all government and government-supported schools. The department is also responsible for deciding teacher postings; one of its primary aims in this regard is to ensure that teacher distribution across the country's schools remains equitable.

A general shortage of teachers is indicated by the fact that 9.2% of teachers at the junior secondary level and 17.6% at the senior secondary level are expatriates. No special effort is in place to recruit teachers into areas such as mathematics and science. As it is, teachers' unions have been actively calling for the removal of differences in salary by level of schooling (primary versus secondary) and type of qualification (diploma versus degree). They argue that this situation constitutes discrimination as defined by various International Labor Organization documents.

Salaries

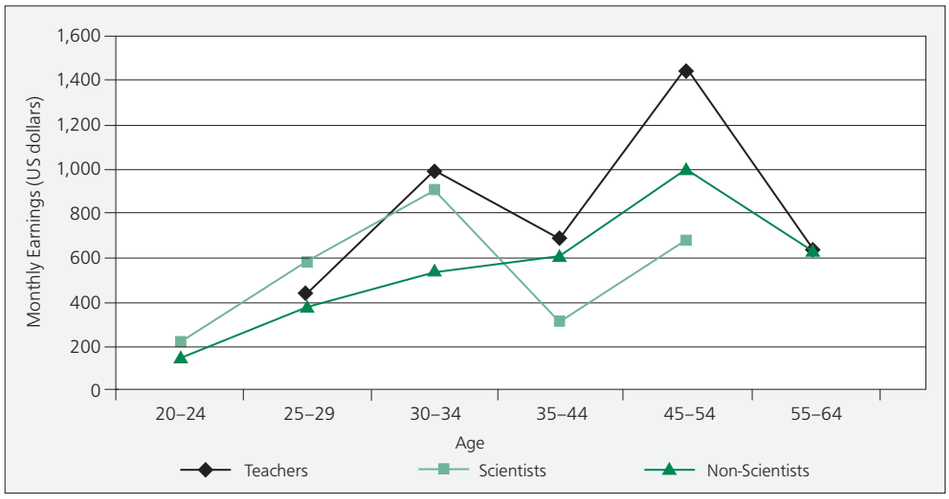
Teachers in Botswana are relatively well paid (see Table 14 and Figures 7 and 8), particularly women. As estimated from the 2002/2003 household survey, female teachers (combined primary and secondary) earn more than scientists and non-scientists, even though the scientists surveyed tended to have higher-level degrees than many of the teachers in the sample. Among males, scientists earn considerably more than teachers, providing evidence for why females are more likely to enter the teaching profession.

Table 14: Botswana, Mean Monthly Earnings of Post-Secondary Degree Holders, 2002 to 2003, by Gender and Occupation

	Males			Females		
Age	*Teachers*	*Scientists*	*Non-scientists*	*Teachers*	*Scientists*	*Non-scientists*
20–24		879	555		223	221
25–29	892	545	722	884	649	605
30–34	1,336	2,733	773	1,044	1,450	693
35–44	1,930	2,046	1,141	782	993	795
45–54	1,366	1,217	1,008	1,673	724	1,246
55–64	2,608	1,683	1,095	634		848

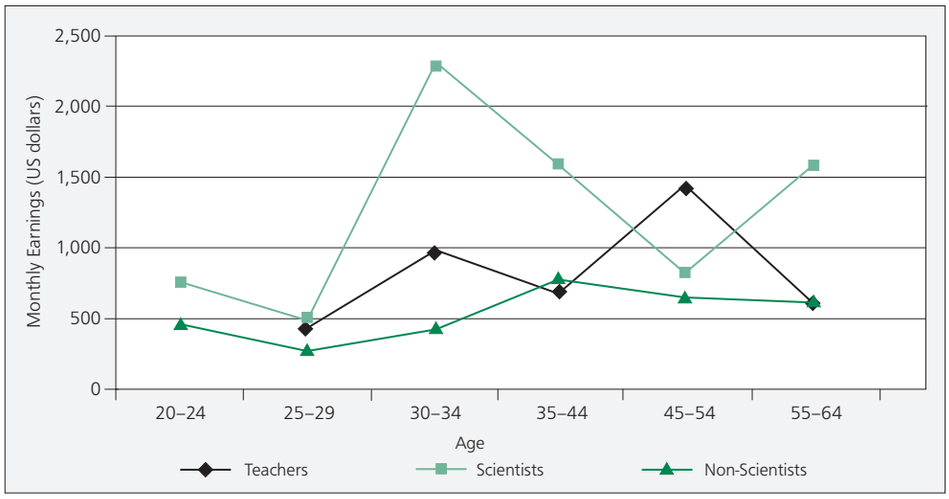
Source: Estimates made from data for 2004 provided by the Central Statistics Office (CSO) and from data from the Household Income Expenditure Survey, 2002/2003.

Figure 7: Botswana, Median Monthly Earnings of Female Post-Secondary Degree Holders, 2002 to 2003



Source: Central Statistics Bureau, Botswana.

Figure 8: Botswana, Median Monthly Earnings of Male Post-Secondary Degree Holders, 2002 to 2003



Source: Central Statistics Bureau, Botswana.

Bulgaria

Composition of the teacher labor force

The Bulgarian education system went through major changes in the 1990s with the economic shift from a command to a market economy. Low birth rates also contributed to the change. Enrollment in primary and secondary school fell steadily (Bulgaria has experienced one of the largest declines in Europe), but there was a steep rise in the number of students in higher education, from 120,000 in 1990 to 258,000 in 2000, a trend that is continuing. Enrollment rates after Grade 8 are relatively low, with only about 67% of the age cohort continuing to secondary school. The school system seems to focus more on selection than on retention. Teachers in primary school are predominantly female. However, as in other European countries, the gap between the number of female teachers and the number of male teachers is not as wide in secondary schools. At both levels, there is a falling demand for teachers.

Educational financing is both centralized (state schools) and decentralized (municipal schools). The latter are funded by a combination of block grants from the Ministry of Finance for Social Services, a share of municipal tax revenues, and extra-budgetary funds raised by the schools themselves.

Teacher education

Both primary and secondary school teachers receive their education in universities. Secondary school teachers must major in the subject they intend to teach. Primary school teachers (Grades 1 to 4) obtain their qualifications from departments of primary education within the faculties of pedagogy at the universities. They are trained to teach all subjects. From Grade 5 on, each class has a special mathematics teacher; these middle and secondary school teachers are required to study mathematics at university level.

Teacher salaries

Although teacher salaries are low, they are not much lower than salaries in competing professions. In the early 2000s, the maximum salary a Grade 1 teacher could expect to receive after 25 years of teaching was 259 leva per month (about $US130). Teacher salary differentials from one step on the teacher scale to the next is also low, only eight leva (approximately $US4) per month, so that the difference between a beginning teacher (Level I) and a teacher with the highest qualification (Level V) is only 40 leva or $US20 per month. There seems to be little or no incentive for teachers to develop professionally, especially given that in-service teacher education courses can be expensive. In the new market economy, teachers can supplement their salaries through other work, reducing their time for non-classroom teaching activities such as class preparation, correction of homework, availability for school planning meetings, and in-service education.

While teaching is still a respected profession, its status appears to be diminishing. Despite this, and the apparent erosion of relative salaries, three factors mitigate against a future shortage of teachers: (i) declining absolute enrollment in primary and secondary schools, (ii) expanding enrollment in universities, and (iii) a shortage of jobs for university graduates. Nevertheless, the quality of university graduates entering teaching may decline, a situation that could affect the quality of mathematics teachers more than the quality of other teachers.

To assess the relative salaries in teaching and how these are changing over time, we used the 1995 and 2001 Bulgaria Integrated Household Survey (BIHS), conducted by BBSS Gallup International under World Bank supervision. The samples in both years consisted of 2,500 households and were nationally representative. The 2001 survey over-sampled 133 Roma households.

The small sample size in Bulgaria means that any conclusions drawn from our findings are tentative. Also, the occupational category that includes teachers also includes education managers, although the salary levels suggest that almost all in the category were teachers. Despite these limitations, the age-earnings profiles show that, in 1995, female teachers/managers earned more than engineers/technicians (but less than accountants). This was not the case for males. Both female teachers/managers and male teachers/managers lost ground to competing occupations between 1995 and 2001. This was especially true for young males and all female teachers (see Table 15 and Figures 9 to 12).

When we translate the monetary values in Table 15, which are in current leva, into current dollars, using the average exchange rates of 1995 and 2001, we see that although average earnings in US dollars rose between 1995 and 2001 (Table 16), the gains for teachers were not as large as they were for engineers/technicians. If the earnings we have estimated for Bulgaria are reasonably accurate, we can surmise that Bulgaria will have far greater difficulty recruiting mathematics teachers over the coming years than it did in the 1980s and early 1990s. Either the quality of mathematics teaching in Bulgaria will decline, or teacher salaries will have to rise.

Table 15: Bulgaria, Mean Monthly Earnings of Teachers/Managers, Engineers/Technicians, and Accountants with University Education, by Gender, 1995 and 2001 (current Bulgarian leva)

	Males with University Education, 1995			Females with University Education, 1995		
Age	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*
20–24						4,380
25–29	6,200	8,298		3,908		4,425
30–34	4,450	8,636	35,505	4,675	4,350	7,352
35–44	5,050	9,483	8,830	4,775	4,202	6,900
45–54	5,000	13,023	7,050	4,700	5,658	6,564
55–64		6,800	15,162			
	Males with University Education, 2001			Females with University Education, 2001		
Age	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*
20–24		230				
25–29	153	300	315	175		214
30–34	153	461	527	162	183	196
35–44	226	275	215	160	211	222
45–54	268	300	300	176	267	231
55–64	172	225	270	224	235	

Source: Estimated from Gallup International, Bulgaria Integrated Household Survey, 1995; Bulgaria Integrated Household Survey, 2001 (http://www.worldbank.org/lsms/country/bg01/bg01docs.html).

Table 16: Bulgaria, Mean Monthly Earnings of Teachers/Managers, Engineers/Technicians, and Accountants with University Education, by Gender, 1995 and 2001 (current US dollars)

	Males with University Education, 1995			Females with University Education, 1995		
Age	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*
20–24						64
25–29	90	120		57		64
30–34	64	125	515	68	63	107
35–44	73	137	128	70	61	101
45–54	72	189	102	69	82	96
55–64		99	220			
	Males with University Education, 2001			Females with University Education, 2001		
Age	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*	*Teachers/Managers*	*Engineers/ Technicians*	*Accountants*
20–24		100				
25–29	67	131	138	76		93
30–34	67	201	230	71	80	86
35–44	99	120	94	70	92	97
45–54	117	131	131	77	117	101
55–64	75	98	118	98	103	

Figure 9: Bulgaria, Mean Weekly Earnings of Males with University Education, by Occupation and Age, 1995

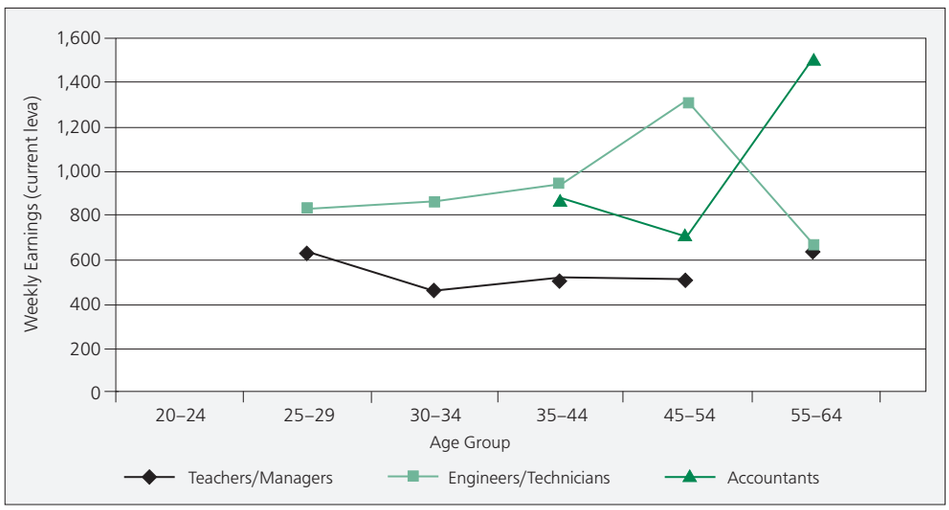


Figure 10: Bulgaria, Mean Weekly Earnings of Females with University Education, by Occupation and Age, 1995

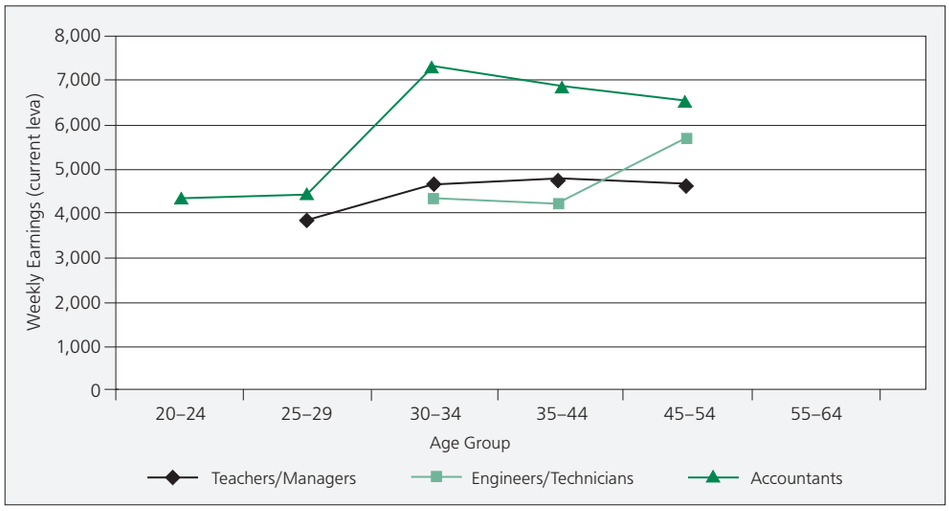


Figure 11: Bulgaria, Mean Weekly Earnings of Males with University Education, by Occupation and Age, 2001

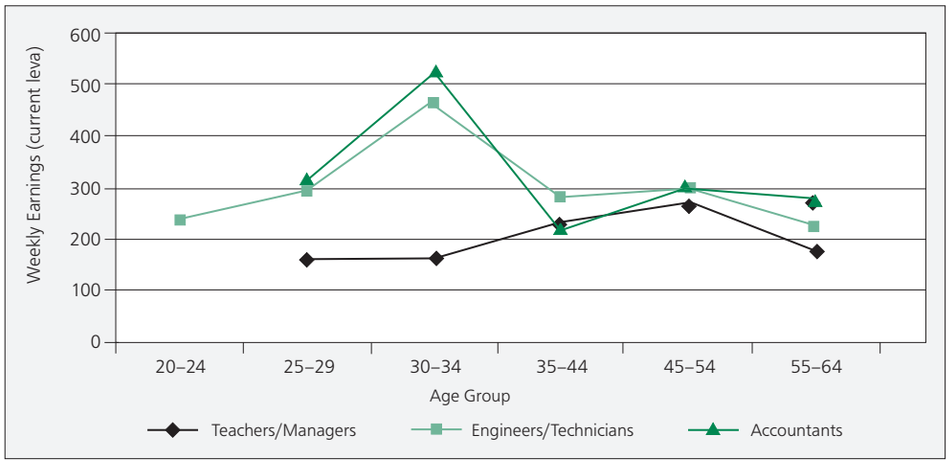
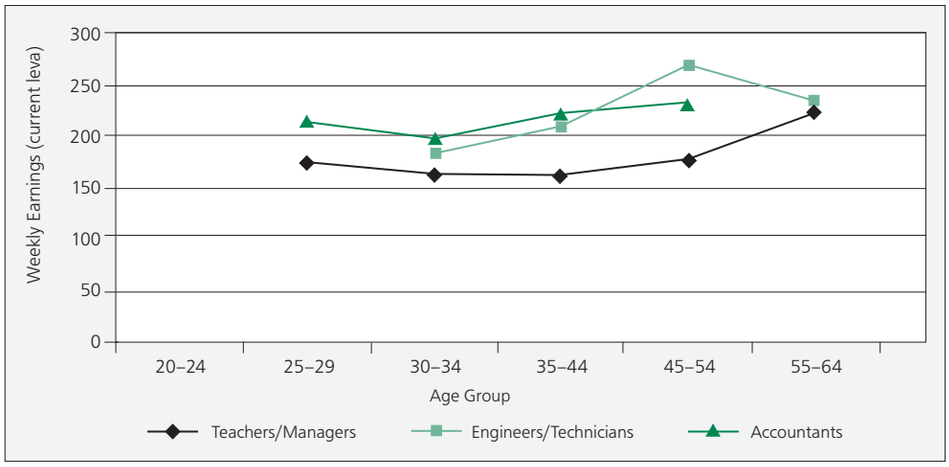


Figure 12: Bulgaria, Mean Weekly Earnings of Females with University Education, by Occupation and Age, 2001



Chile

Composition of the teacher labor force

Chile's overall primary and secondary school teaching force in 2006 was 133,000 (World Bank, n.d.). Based on earlier data, about another 20,000 were principals or were engaged in technical and other pedagogical-type roles (OECD, 2004, p. 121). Over 80,000 of the teachers were members of the Teachers' Association. The number of teachers rose steadily in the years preceding 2005, but has now leveled off. This increase was linked to the need for additional teachers to support Chile's "whole school day" policy, inaugurated in 1997, which has increased the length of the school day gradually from four to six hours over a number of years. It is also linked to general increases in student participation. In 2006, female teachers comprised about 70% of the teaching force; however, the gender imbalance in favor of females was much more apparent in preschools and elementary schools than in secondary schools (Grades 9 to 12)—78% female in primary schools and 63% in secondary (World Bank, n.d.).

Teachers are no longer civil service employees.[10] However, since the early 1990s, when teachers' unions were once again allowed to represent teachers, those teaching in public municipal schools have enjoyed stable employment. Municipal teachers also obtain their positions through open, public competition. Teachers who work in the private subsidized sector are governed by private individual contracts, regulated by the rules of the Labor Code, with some safeguards. The selection procedures for teachers in the private sector are not regulated, except for the Labor Code. Because fixed-term contracts apply in private schools, the high proportion of teachers working there do not have the security of tenure of their public-sector colleagues. Of the total teaching force, 55% are employed in municipal schools, a percentage that generally corresponds with the proportion of the student cohort enrolled in these schools.

The age pattern of the teaching force differs between private and public schools. Although, overall, 71% of teachers in the system are over 35 years of age, teachers in public schools tend to be much older. About 86% are over 35 years of age compared to 58% in private subsidized schools (Table 17). Because private schools have a greater incentive to reduce costs, they tend to hire younger teachers (lower pay) and fire older teachers (higher pay). Most newly graduating teachers begin their careers in private schools, gain experience there, and try to transfer to public schools as they get older, in order to obtain tenure and assure themselves of a long-term career in the profession (OECD, 2004).

The contractual hours for teachers, in the context of the full school day policy, are 44 hours per week, which is considerably higher than the OECD average. In the early 2000s, 32% of teachers were engaged for 44 or more hours per week. A further 25% were engaged between 31 and 43 hours, and 29% for 30 hours. The remaining 14% were regarded as part-time teachers engaged for 29 hours or fewer (OECD, 2004 p. 47). This variability in teacher work time was largely a function of the partial shift from the traditional four-hour school day to the six-hour ("whole") school day. Before the whole

10 In the early 1980s, the military government decreed that teachers were no longer civil servants, and that they would be employed as in any other field, under regular contracts. The government "bought out" the teachers' civil service contracts.

Table 17: Chile, Teachers, by Type of School and Age, 2000 (%)

	Type of School			
Age	*Total*	*Municipal*	*Private Subsidized*	*Private Paid*
18–24	3.4	1.2	6.1	2.8
25–34	25.2	13.0	36.1	29.3
35–54	62.9	74.4	51.7	60.8
55+	8.5	11.4	6.1	7.2
Total	100.0	100.0	100.0	100.0

Source: Mizala and Romaguera (2001, Table 3).

school day reform began, teachers commonly worked in more than one school, but data now suggest a drop in this practice to the extent that only 13% of teachers do so.

The national average figures in the early 2000s for the student–teacher ratio, measured as the number of students divided by overall teacher numbers, work out as follows: 23 students per teacher in municipal schools, 31 in private subsidized schools, and 15 in private schools (OECD, 2004, p. 46). However, national averages mask substantial variations between urban and rural and remote rural schools. The average class size in 2005 was 31 students (OECD, 2007, Chart D2.2). Class sizes in urban areas tend to be much larger, with the recommended maximum set at 45 students per class.

Teacher education

In Chile, 90% of teachers have a university degree. The remaining 10% with lower qualifications or experience are "authorized" to teach under particular circumstances. Teacher education in Chile is highly decentralized, as it takes place in universities. The Ministry of Education has little control over the teacher education curriculum because of the principle of university autonomy. Most trainee teachers study at the large public universities that used to be part of the University of Chile, and they have to pay the tuition fees themselves, even at public universities.

One of the major problems associated with teacher preparation is that basic education in Chile is defined as kindergarten through Grade 8. Teachers teaching in Grades 5 to 8, where subject matter becomes more complex and challenging, receive their pre-service education in basic-education programs, which means that they do not have to have a degree in the subject matter taught, as do secondary school teachers. This situation has been identified as one of the key barriers to improving the quality of Chilean education (OECD, 2004).

Teacher recruitment and hiring

In the 1980s, Chile's military regime dismantled the civil service foundation of the teaching profession, did its best to create a market basis for hiring and firing teachers (the unions were banned as well), and lowered the real salaries of teachers by reducing the value of the voucher paid per student enrolled in a private or public school. The democratic governments since 1990 have pursued policies and measures, including very large increases in teachers' real salaries, to counteract this depreciation of the teaching profession.

However, the market basis for hiring and firing teachers is generally still in place. The government does not certify education graduates to teach; the university degree in education is what qualifies them to teach. Teachers apply to individual private schools and to municipalities for positions. In recent years, teaching has been viewed more positively as a career. This viewpoint reflects improved salaries and better teacher education provision. Today, the teaching profession attracts larger numbers of higher ability students. As an example of this trend, the number of students studying to become teachers increased from 19,995 in 1997 to 27,817 by 2001, an increase of almost 40% (OECD, 2004, p. 133). In 2002, for the first time, teaching displaced engineering as the university program with the most applicants. Competition for entry has increased, particularly for teaching in primary education. Since 1998, there has been a sustained increase in the scores obtained by entrants in the admission tests for higher education (see Table 18).

Table 18: Chile, Increase in Scores on the University Admission Test Obtained by Applicants to Teacher Education Faculties, 1998 to 2001

	Type of Teacher Education			
Year	*Pre-School*	*Elementary*	*Secondary*	*Special*
1998	535	540	533	554
1999	506	552	543	566
2000	559	571	555	571
2001	570	587	580	592
Increase	6%	8%	10%	6%

Source: OECD (2004, Table 3, p. 133).

In 1998, the government set up a university scholarship scheme to attract into education faculties high school students of outstanding performance. Such students were deemed to be those with over 600 points in the Higher Education Admission Tests and/or had achieved high grades during secondary school. The scholarship scheme also aimed to attract individuals with teaching experience and graduates from other disciplines. The scholarship finances the entire pre-service education of student teachers and can also include educational materials. Because even public universities in Chile charge substantial tuition fees, the scholarship represents a major incentive for students to commit themselves to education. Between 1998 and 2001, the number of scholarships doubled from 122 (more than 600 applicants) in 1998 to 291 in 2002 (almost 4,000 applicants) (OECD, 2004, pp. 133–134).

Teacher salaries

Since the early 1990s, the Chilean government has had a policy of sustained and large increases in teacher salaries across the board (see Table 19). In real terms, actual teacher base-monthly salaries in municipal (public) schools increased an average of 8.4% annually from 1990 to 2000, but slowed to 3.9% annually between 1996 and 2000. The minimum salary in private subsidized (voucher) schools increased at a lower rate in the decade as a whole, but also at about a 4% rate from 1996 to 2000 (OECD, 2004, Fig. 6). Salaries continued to increase at the slower rate after 2000.

Table 19: Chile, Average Monthly Teacher Salary for 44-Hour Week and Minimum Salary, by Year and Type of School (pesos for year 2000)

Average Salary and Legal Minimum Salary at Entry			
Year	*Average Teacher Salary*	*Minimum Municipal*	*Minimum Private Subsidized*
1990	252,539	138,880	71,429
1991	265,348	165,663	153,980
1992	309,954	183,390	176,516
1993	348,711	194,157	180,244
1994	396,630	225,362	201,563
1995	436,453	248,681	243,526
1996	468,698	273,374	272,193
1997	512,124	300,193	298,647
1998	538,605	327,167	326,928
1999	565,609	349,238	349,238
2000	594,158	372,057	372,057
2001	631,010	391,750	391,750

Source: Mizala and Romaguera (2001, Table 13).

The government also implemented a system of salary bonuses based on school performance in the national SIMCE (Education Quality Measurement System) tests that students in Chilean schools sit every two years (Grade 4 in even years and Grade 8 in odd years). The National System for Assessing School Performance (SNED) awards are given in each award year to the highest-rated schools within each of several sets of schools (grouped according to the socioeconomic status of the communities from which the schools draw their students), until those rewarded account for 25% of enrollments within each province (there are 13 provinces in Chile). The SNED rating is arrived at through a series of measures that compare schools in the same "homogeneous grouping" within each region. When determining the awards, the SNED adjusts for the average SES background of students in a school and whether the school is in an urban or a rural area, which means the awards are well distributed among private and public schools and among urban and rural schools (Mizala & Romaguera, 2003).

During the period 1996 to 2000, almost one-half of all Chilean schools received at least one award. The awards are about $US400 to $US500 annually per teacher in bonus-winning schools (accounting for about 5% of annual salary). However, because so many schools (about 1,600 to 2,200, depending on the year) and teachers (about 30,000) receive the bonuses every year (the government spent $US12.5M on bonuses in 1996/1997, $US13.5M in 1998/1999, and $US16.5M in 2000/2001), the awards expenditure had risen to $US18.5M by 2004/2005.

We estimated Chilean teachers' salaries against the salaries of scientists and engineers and by gender in 1996 and 2003. We show the mean hourly wages in Table 20. The data we used came from the annual Chilean household survey (CASEN), so the samples were relatively small. We identified scientists as all types of physical and biological scientists, and engineers as all types of engineer, despite the fact that we ended up with two rather heterogeneous groups. (This type of grouping was also the case in other countries, though.) The effect of teacher salary increases in the late 1990s and early

2000s made the salaries of female teachers competitive with those of female scientists and engineers; the latter are paid relatively low salaries in the Chilean private sector. The monthly salaries were lower than those of scientists and engineers, but the differences declined between 1996 and 2003, particularly between female teachers and engineers (Table 20 and Figures 13 to 16).

Table 20: Chile, Mean Hourly Earnings, by Gender, Age, and Occupation, 1996 and 2003 (current Chilean pesos)

	Males			Females		
Age	*Scientists*	*Engineers*	*Teachers*	*Scientists*	*Engineers*	*Teachers*
			1996			
25–29	1,841	3,010	1,875		3,012	1,205
30–34	4,645	4,011	2,321	2,423	3,381	3,044
35–44	5,450	4,488	2,771	1,590	3,353	2,387
45–54	1,500	5,858	3,227		3,804	2,754
55+	1,275	3,560	4,107			2,178
			2003			
Age	*Scientists*	*Engineers*	*Teachers*	*Scientists*	*Engineers*	*Teachers*
25–29	2,361	3,209	2,992	1,849	1,382	2,240
30–34	4,058	4,319	2,099	3,915	2,772	3,451
35–44	3,629	5,782	3,432	3,662	1,945	3,733
45–54	9,839	6,556	5,172	2,542	4,707	4,763
55+	15,260	10,207	5,155	2,137	2,448	4,974

Source: Ministry of Planning (1996, 2003).

Figure 13: Chile, Median Monthly Earnings of Male Teachers, Engineers, and Scientists, by Age, 1996

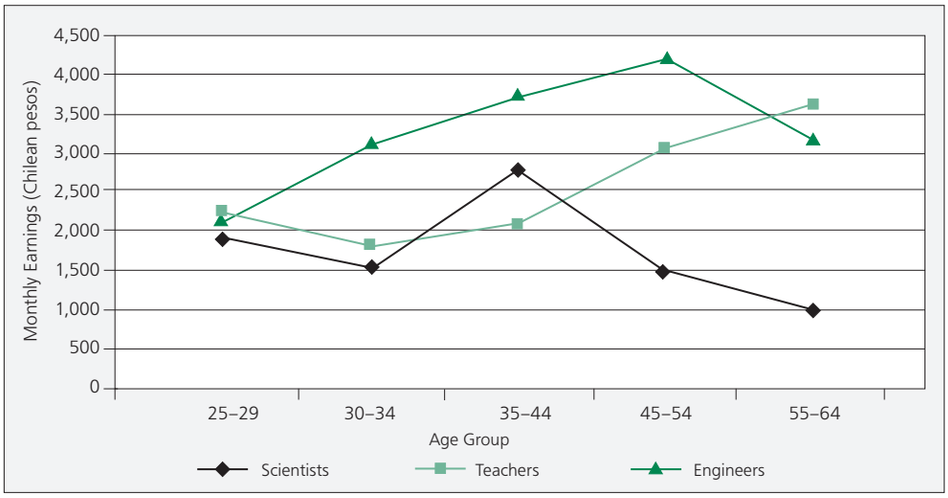


Figure 14: Chile, Median Monthly Earnings of Female Teachers, Engineers, and Scientists, by Age, 1996

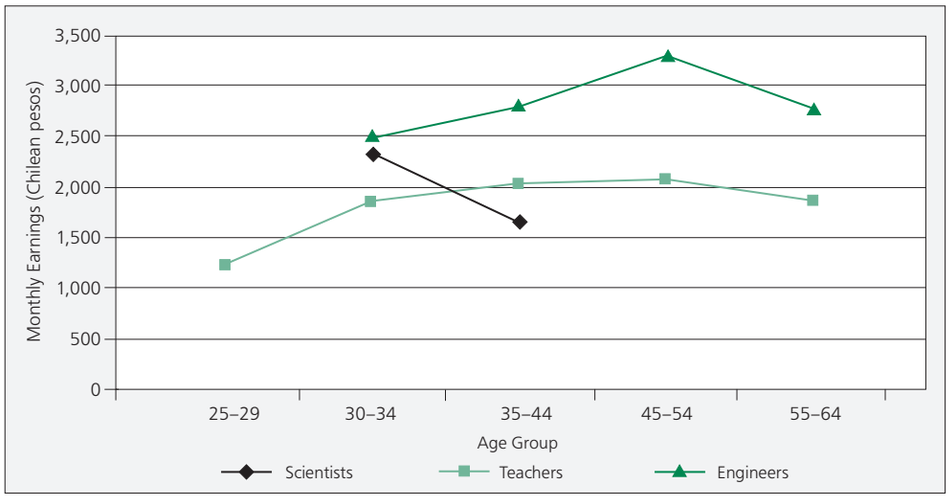


Figure 15: Chile, Median Monthly Earnings of Male Teachers, Engineers, and Scientists, by Age, 2003

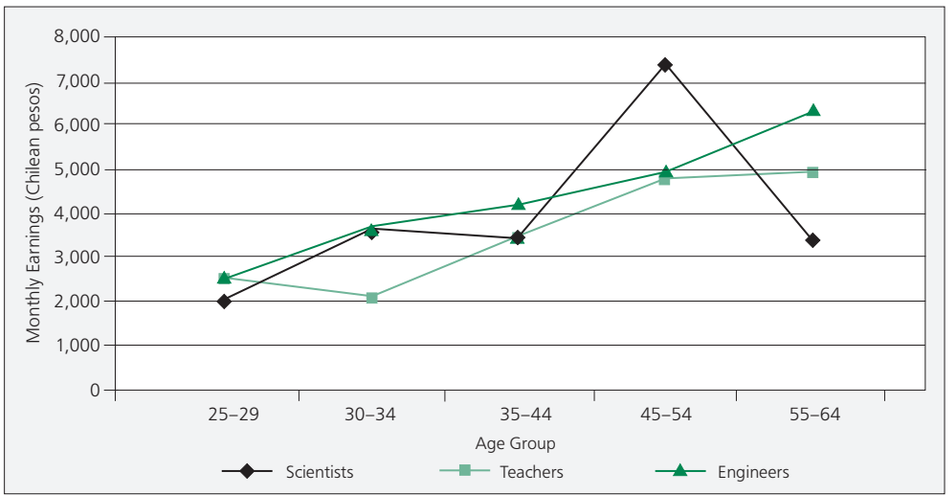
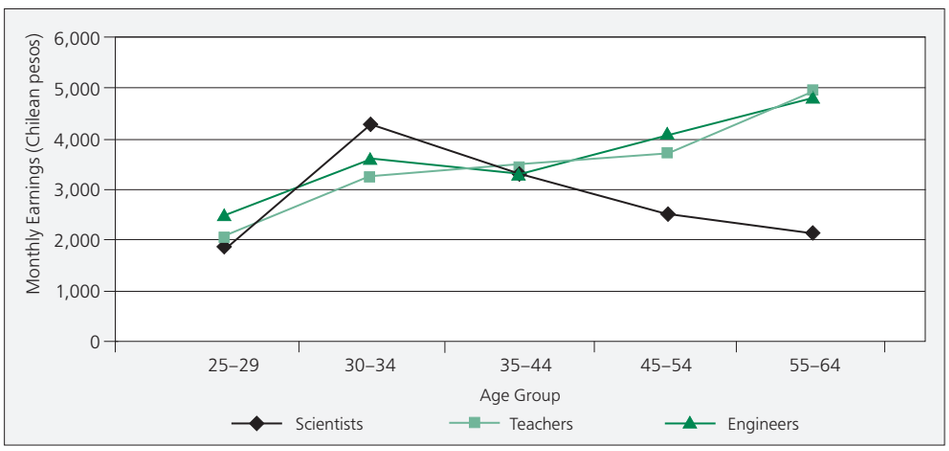


Figure 16: Chile, Median Monthly Earnings of Female Teachers, Engineers, and Scientists, by Age, 2003



References

Ministry of Planning. (1996). *La Encuesta Nacional de Caracterizacion Socioeconomica (The National Characterization Socioeconomic Survey)* (CASEN). Santiago: Author.

Ministry of Planning. (2003). *La Encuesta Nacional de Caracterizacion Socioeconomica (The National Characterization Socioeconomic Survey)* (CASEN). Santiago: Author. Available online in English at http://www.midplan.cl/casen/en/index.html.

Mizala, A., & Romaguera, P. (2003). *Sistemas de incentivos en educación y la experiencia del SNED en Chile (Incentive systems in education and the experience with the SNED in Chile)* (documento de Trabajo N° 82). Santiago: Centro de Economía Aplicada, Depto. de Ingeniería Industrial, University of Chile.

Mizala, A., & Romaguera, P. (2002). Evaluación del desempeño e incentivos en la educacion chilena (Evaluation of outcomes and incentives in Chilean education). *Cuadernos de Economía, 39*(118), 353–394.

Mizala, A. & Romaguera, P. (2001). Regulación, incentives, y remuneraciones de los profesores en Chile (Regulation, incentives, and remuneration of teachers in Chile). In Cox, C. (Ed.), *Politicas educacionales para el cambio del siglo: La reforma del sistema escolar en Chile (Educational policies for the the new century: The reform of the school system in Chile)*. Santiago: Editorial Universitaria.

Organisation for Economic Co-operation and Development (OECD). (2004). *Chile: Review of national policies for education*. Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2007). *Education at a glance 2007*. Paris: Author.

World Bank. (n.d.). *World development indicators*. Washington, DC: Author.

Chinese Taipei

Composition of the teacher labor force

From the mid-1990s on, the number of primary and middle school teachers in Chinese Taipei began to decline, consistent with declines in the number of students at those levels. The number of non-vocational senior high school teachers continued to grow, however, increasing by just over 50% between 1996 and 2004. About one-half of this growth represented a shift of students and teachers from vocational to non-vocational high schools. The total number of public school teachers in 2002 was 171,472, and the total number of private school teachers was 14,288. In 2003, about 68% of elementary school teachers and nearly 61% of secondary school teachers were female.

Teacher education

Chinese Taipei's teachers are generally trained along two separate lines: pre-service secondary school teachers attend four-year normal universities, while pre-service kindergarten and elementary school teachers attend four-year junior normal or teachers' colleges. Overlap sometimes occurs because prospective elementary school teachers can study in normal universities and prospective secondary school teachers can study in normal colleges. In addition, potential teachers can graduate from public or private universities that have departments of education. All students who graduate from regular universities have the option of additionally completing requisite credits in education programs. Admission to teacher education programs is often very competitive; at times only 15% or less of the applicants—those with the strongest academic qualifications—are selected.

Over the last few decades, Chinese Taipei has been successful in attracting high-achieving students into the teaching profession. Even so, the education level of teachers in Chinese Taipei has stayed fairly uniform. In 2004, 99.6% of elementary teachers received at least a basic teacher education, 99.7% received at least a junior college education, and 95.4% of middle and high school teachers secured a Bachelor's degree. In 2002, only 6.6% of elementary teachers and 9.7% of secondary teachers possessed a Master's degree.

Today, Chinese Taipei has an oversupply of teachers at all levels. According to the Ministry of Education (2007a, 2007b), the teacher education institutions sharply reduced their intake in academic year 2007. The total number of students in teacher education institutions declined from 22,000 in 2004 to 14,000 in 2006. It dropped another 4,000 between 2006 and 2007.

Within the various teacher education programs, students take common courses, disciplinary courses, and education specialization courses, followed by a six-month practicum. Elementary-level candidates are required to take 40 units in professional education subjects; secondary-level candidates need to take only 26 units (Lin, 2000). Students studying at regular universities generally take about two years of teacher education classes concurrently with their major study. On completing their study, students receive a teaching certificate and must then pass an examination sponsored by the Ministry of Education to obtain their final qualification.

In order to facilitate improvements in teacher efficiency, the Ministry of Education sponsors on-the-job education for secondary school teachers through National Taiwan Normal University or the Institute for Secondary School Teachers in Chinese Taipei.

Municipal governments also have a few in-service centers in place to provide teachers with rotational training in content, methods, and instruction.

Teacher recruitment

Chinese Taipei recruitment policies apply across the nation. The country has made no major efforts to recruit mathematics and science teachers, and mathematics and science teachers do not receive special premiums or bonuses beyond their standard salaries. The reason may be because of the relatively large supply of science and technology graduates within the country—slightly more than half of all recent college graduates had science and technology backgrounds. Also, teacher education programs in universities have been successful in recent years in terms of drawing graduate-level science students into teaching. These graduates are possibly attracted to the profession's pay and benefits, good working conditions, and high social status. Because the government controls the number of teachers trained, they can also control the supply of teachers to the labor market. As noted, there has been a sharp decrease in the number of students accepted for pre-service education, an indicator that recruitment has been highly successful. However, declining student enrollments suggest that the number of teachers available to teach is currently exceeding demand.

Teacher salaries

Both males and females, at all school levels, are paid according to the same national schedule. The salary scheme is based on the educational background of the teacher, the number of years of teaching experience, and special bonuses based on academic research, administrative position, and geographic remoteness from a major city. Generally, all teachers receive both their basic pay and a research allowance. This payment schedule makes teachers' salaries slightly higher than the salaries of ordinary civil service employees. Also, despite teachers being required to teach for only nine months of the year, they are paid for 12 months. They furthermore receive one month of merit pay and one-and-a-half-months of pay as a New Year bonus, although most other professions in Chinese Taipei receive at least one month of pay as a New Year bonus.

Teachers at all public schools receive near identical welfare benefits, whereas teachers at private schools receive various welfare packages; the one each teacher receives depends on his or her particular circumstances. For public school teachers, benefits include public housing, low-interest housing loans, opportunity to participate in study abroad tours, retirement payments, education allowances for dependants, and insurance. Insurance, which constitutes 4.5% to 9% of basic pay, is also mandated for private schools. Public school teachers can additionally receive mutual assistance payments for marriage, layoffs, retirement, and funerals. Because teaching is considered to be a relatively stable job with little chance of being fired or laid off, it offers reasonably secure lifetime employment.

Teacher compensation as a whole has been very competitive with other occupations. According to the Ministry of Education, in 1999, teachers purportedly earned 25% more than average college graduates with similar qualifications. In 2004, the average monthly salary of an employee in the broad professional, scientific, and technical services industry category was around $NT48–49,000, while that of a first-year teacher was around $NT40,000 (Directorate-General of Budget, Accounting, and Statistics, 2005; Ministry of Education 2005); these amounts did not include the New Year bonuses. Because teachers receive a larger New Year bonus (2.5 months) than do other government

workers (1.5 months) and professionals in many private-sector firms, their salaries (including bonuses) can exceed the total compensation in other professions. Also, even though applied science graduates who enter hi-tech industries earn substantially more than teachers, their jobs have greater stress and less stability. Basic science graduates, who have fewer long-term positions available to them, may opt for teaching.

Teachers in Chinese Taipei are also still accorded respect and a generally high social status because of the traditional value that the country places on teachers and education. Teacher satisfaction might therefore be fairly high because of the combination of reasonable returns, job stability, and social status. In recent years, though, graduates from teachers' colleges have not always found it possible to secure jobs. This situation, along with a continuous wave of educational reforms and an increased number of cases of parents suing teachers, has led to a lower overall level of satisfaction.

Comparative salary estimates

The official teacher salary schedule for Chinese Taipei's public school teachers in 2004 (including the "academic research bonus" and the New Year bonus of 2.5 months of pay) provides the salary scale shown in Table 21. (Note that the information given in the table makes some assumptions about years of experience relative to age.) As the table shows, there is no difference in the pay schedules for men and women. A new teacher with a Master's degree has a substantial earnings benefit, but this lessens with increased years of service. We also used the salary schedule depicted in Table 22 as a means of checking the earnings estimates we conducted for various occupations drawn from household survey data (see below).

Table 21: Chinese Taipei, Teacher Monthly Salary Schedule, Including New Year's Bonus, by Age (Experience) and Education, 2004 (US dollars)

Age	Bachelor's Degree	Master's Degree
20–24	1,413	1,666
25–29	1,527	1,746
30–34	1,726	1,846
35–44	2,004	2,115
45–54	2,205	2,516
55–64	2,586	2,697

Source: Data provided to authors by the Ministry of Education through academic correspondents at National Chung Cheng University.

The household survey data allowed us to compare reported teacher salaries with the salaries of individuals in other occupations (Table 22). An issue we had to contend with, though, was how to compare salaries in a way that took into account the New Year bonus, which varies across professions in Chinese Taipei. We eventually decided not to include the bonus in our estimates because our aim was to compare salaries, not to estimate the absolute level of salaries. It may be that our comparisons underestimate how much teachers earn compared to other mathematics-oriented professionals. This certainly would be the case if, for example, many of the non-teacher professionals are employed by the government, or if the private sector pays low bonuses during the comparison years. The years immediately after 1997 were ones of relatively low economic growth in Asia, a situation that may have resulted in low bonuses for private-sector workers.

Table 22: Chinese Taipei, Median Monthly Professional Earnings, by Gender, Degree, Age, and Occupation, 1997 and 2004 (US dollars)

	Females with Bachelor's Degree, 1997			Males with Bachelor's Degree, 1997		
Age	*Scientists*	*Teachers*	*Non-Scientists*	*Scientists*	*Teachers*	*Non-Scientists*
20–24	753	976	754	1,172	925	686
25–29	953	1,098	1,009	1,090	1,233	1,065
30–34	1,225	1,209	1,110	1,316	1,270	1,300
35–44	1,298	1,420	1,291	1,586	1,490	1,593
45–54		1,547	1,566	1,822	1,529	1,739
55–64		1,521	1,431	1,631	1,776	1,700
	Females with Bachelor's Degree, 2004			Males with Bachelor's Degree, 2004		
Age	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*
20–24	841	714	721	1,097	493	665
25–29	1,122	1,114	955	1,108	1,180	1,006
30–34	1,355	1,306	1,131	1,329	1,393	1,343
35–44	1,480	1,474	1,324	1,628	1,646	1,608
45–54		1,740	1,574	2,007	1,839	1,770
55–64		1,730	1,198	2,038	1,963	1,980
	Females with Master's Degree, 1997			Males with Master's Degree, 1997		
Age	*Scientists*	*Teachers*	*Non-Scientists*	*Scientists*	*Teachers*	*Non-Scientists*
20–24		1,355	1,156		452	448
25–29	972	1,277	1,177	1,290	1,154	915
30–34	1,241	1,191	1,201	1,563	1,441	1,562
35–44	1,597	1,419	1,426	2,010	1,719	1,999
45–54		1,946	1,947	1,992	1,932	2,183
55–64		1,438	1,530	2,258	1,923	2,295
	Females with Master's Degree, 2004			Males with Master's Degree, 2004		
Age	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*	*Maths/Science Occupations*	*Teachers*	*All Other Occupations*
20–24			425	241		369
25–29	1,120	1,190	1,201	1,286	761	1,036
30–34	1,589	1,447	1,411	1,502	1,504	1,601
35–44	1,153	1,586	1,491	1,878	1,593	1,897
45–54		1,886	1,884	2,078	1,963	2116
55–64			2,077	2,408	1,876	2,267

Source: Estimated from Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taiwan Manpower Utilization Surveys, 1997 and 2004.

As in Korea (see the section on Korea, below), teachers in Chinese Taipei do very well salary-wise compared to individuals in other occupations, even when bonuses are not included. The salaries for teachers estimated from the 2004 household survey data were lower than those in the overall salary schedule, probably reflecting the fact that some teachers work in private schools. Also, the female teachers appear to have been earning less than the male teachers.

Teachers with Bachelor's degrees, who represent just over 90% of teachers, earned approximately the same as scientists and non-scientists if they were males, and tended to earn more than scientists and non-scientists if they were female (Figures 17 and 18). By 2004, female teachers with Bachelor's degrees had lost some ground to competing occupations, but the respective salaries were still relatively even. For female teachers with Master's degrees, the situation between 1997 and 2004 seemed to become more favorable, with teachers earning approximately the same in 1997 and somewhat more in 2004 than workers in competing professions. Male teachers with Master's degrees earned less in both years than did males in competing professions. Teachers seemed to make bigger salary gains than other professionals during the period 1997 to 2004; this is especially evident in the comparison between teachers and non-scientists (see Figures 17 and 18). Given that teachers probably realize larger bonuses and have much more vacation time than their counterparts working as scientists or non-scientists, it seems reasonable to conclude that teachers receive the higher remuneration (salary and non-salary).

To summarize, mathematics teachers in Chinese Taipei generally earn comparable (males) or higher (females) median incomes than scientists, but this differential does not take into account other favorable treatment that teachers receive, most obviously possibly larger bonuses, more vacation time, and greater job security. If all else were equal, we could assume that, as in Korea, the Ministry of Education in Chinese Taipei would experience little difficulty recruiting people of relatively high mathematical ability into teaching. Indeed, as we discussed above, the overly high number of teachers graduating from teacher education institutions in recent years led the government to substantially reduce admissions into teacher education programs.

In part, and again as in Korea, high relative teacher salaries are probably the result of a relatively equal income distribution in Chinese Taipei. Teacher pay policy has clearly been favorable, as shown by the large increases in median teacher salaries between 1997 and 2004. However, the fact that teacher salaries are so high relative to scientists' salaries suggests that the relatively low variance in incomes reduces the possibility that those with high mathematics skills can earn much higher salaries than teachers. Although the variance in non-scientists' salaries is much higher than the variance in teachers' salaries, and although the variance of scientists' salaries is somewhat higher than that of teachers' (especially for males), even those male non-scientists holding Bachelor's degrees and presenting as one standard deviation above the median salaries in 2004 earned only $NTK1,000 to $NT1,200 per month (not including the New Year bonus) more than male teachers. For those male non-scientists with Master's degrees, presenting as one standard deviation above the median salary and in the 35 to 44 years of age bracket, the difference was as high as $NT2,800 per month. However, the difference was no higher than $NT300 per month for male scientists presenting as one standard deviation above the median. So, for those with "risk preference," teaching in Chinese Taipei does have salary limitations, but these are not nearly as costly as those in other professions.

Figure 17: Chinese Taipei, Median Monthly Earnings of Males with Bachelor's Degree, by Age and Occupation, 1997 and 2004

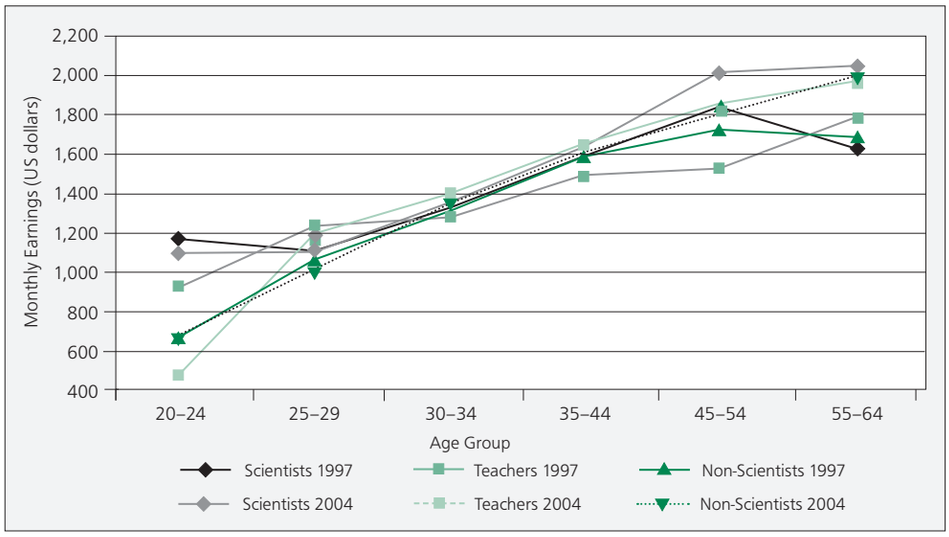
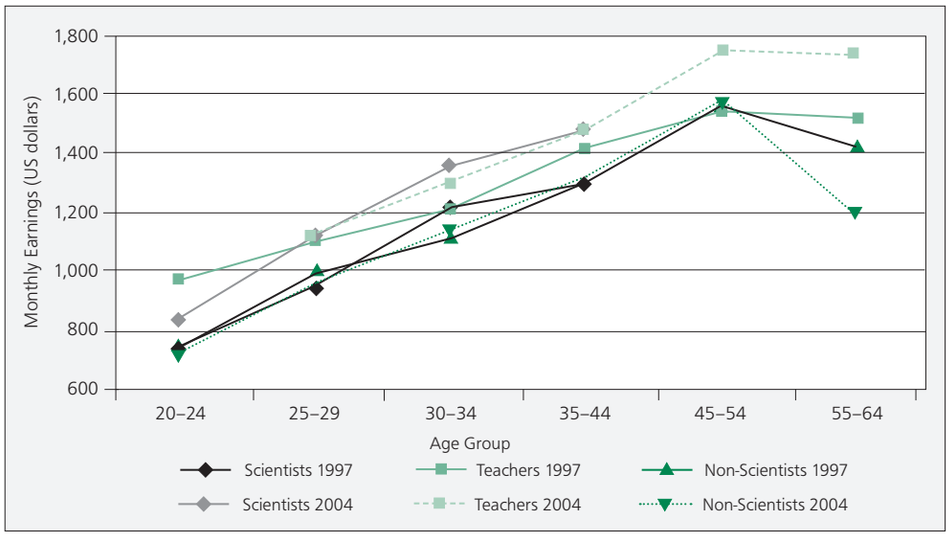


Figure 18: Chinese Taipei, Median Monthly Earnings of Females with Bachelor's Degree, by Age and Occupation, 1997 and 2004



References

Directorate-General of Budget, Accounting, and Statistics (DGBAS) Taiwan. (2005). *Website.* Retrieved May 26, 2009, from http://eng.dgbas.gov.tw/mp.asp?mp=2.

Lin, T. (2000). *Professional development for elementary mathematics teachers in Taiwan.* Paper presented at the annual meeting of the American Educational Research Association, April 24–28, 2000, New Orleans.

Ministry of Education. (2007a). *Educational statistics: Summary of statistics.* Retrieved May 26, 2009, from http://english.moe.gov.tw/ct.asp?xitem=946&ct Node=1184&mp=1.

Ministry of Education. (2007b). *Statistics on students in teacher training programs during academic years 2004–2007*. Retrieved May 26, 2009, from http://english.moe.gov.tw/ct.asp?xItem=7487&ct Node=1184&mp=1.

Finland

Composition of the teacher labor force

Finland's education system employed about 66,000 Finnish- and Swedish-speaking instructors in 2002. Of this number, 45,568 were teaching in primary and lower-secondary schools, 7,846 were teaching in general upper-secondary schools, and 12,486 were working within vocational education. The numbers have declined somewhat in subsequent years, according to the World Bank's *World Development Indicators*. Just over 90% of the entire teaching cohort works full-time. The majority of teachers are female, with 75% in primary and lower-secondary schools and 67% in upper-secondary schools. Ninety-five percent of the teachers in the general upper-secondary schools and 75% of the teachers in vocational education had formal qualifications. There were also about 20,000 class (primary) and preschool teachers and approximately 16,400 subject-specialist teachers.

Finland's teachers are generally older than teachers in other countries. Age distributions show that the largest number of upper-secondary school teachers is in the 50 to 59 year range, while the largest number of basic-education teachers is in the 40 to 49 and the 50 to 59 year ranges. There are also relatively few vocational education teachers under 30 years of age, as these teachers usually acquire ample work experience before they enter schools. On average, non-urban areas have a slightly larger proportion of older teachers. Also important is the fact that the relative sizes of the population's younger age cohorts are declining.

It is thus becoming increasingly important for Finland to pay attention to the risk of teacher labor shortages because of the present age distribution. By 2010, as the baby boomers retire, local authorities will have to compete harder for educated labor. In recent years, many teachers have indeed retired, taken early retirement, or entered semi-retirement. It is estimated that a total of about 20,000 teachers will retire between 2000 and 2010. The older teachers might also experience difficulty meeting the challenges of a rapidly changing society and handling increasingly complex work conditions. Some of these teachers have already claimed stress and mental debilitation as a reason for early retirement.

The teacher labor market faces the additional problem of many teachers moving from rural to growing urban areas. This situation is causing a shortage of certain types of qualified teachers in both areas, especially for mathematics and science. Furthermore, because people are migrating away from the rural areas of eastern and northern Finland, the proportion of children and working adults in these areas has also declined. This development has led to the closure of smaller schools in remote areas, and the building of new facilities in urban regions. Over the long-term, this redistribution of the quality of facilities and educational services could influence where teachers are willing to work.

Promoting an ideal distribution of qualified teachers around the country consequently is another issue of growing concern, especially given that Finland's education system upholds the principle that every citizen should be able to receive quality schooling. Sometimes, teacher education graduates do find jobs in rural localities near the university they graduated from or in their home towns, but further incentives are needed to attract and retain teachers in those localities.

At least 10% to 15% of all teacher education graduates and 15% of subject-matter teachers tend to leave teaching and move into other occupations. Teachers in the fields of mathematics, science, and languages seem to be much more likely to find jobs in private industries. Male teachers are more likely than female teachers to move into other occupations. Economic cycles also affect the number of teachers in the labor market because more teachers find jobs outside of education during economic booms.

These various circumstances have led not only to an expectation of teacher shortages, but also to an acknowledgement of the need to increase the capacity of particular teacher education programs. Many students are willing to enter distinct teaching fields, including class teacher and special-needs education, counseling, arts, and practical subjects. Certain teaching fields, such as mathematics and the natural sciences, however, have a shortage of qualified teachers and applicants. In vocational education, there is a shortage of applicants for technology and transportation, as well as for business and administration education.

Policymakers will also have to account for the small but gradual decrease in the number of males applying for teacher education programs. Overall, the number of men entering teacher education programs is less than the number leaving teaching, and this is especially true for basic and subject-specific teacher education. A survey conducted by the Confederation of Unions for Academic Professionals (AKAVA) during 2000 to 2002 found that whereas 85% of all respondents taught for at least four to five years after graduation, only 66% of male respondents continued with their teaching careers after graduation.

Teaching has traditionally been seen as a respected profession in Finland. However, recent perceptions about the heavier workload of teachers, their responsibility for multiple tasks, including student welfare, a lack of discipline among students, and occasional violence in schools have made teaching less attractive.

Teacher recruitment, hiring, and education

In Finland, basic- and upper-secondary education is provided almost entirely through municipalities, joint municipal boards, and non-profit private institutions. The municipalities manage most schools: 98% of comprehensive, 90% of upper-secondary, and 70% of vocational. Local authorities are required to provide preschool and basic education within their jurisdictions. They must also be licensed by the government to provide general upper-secondary and vocational education. Within this context, teachers are generally considered to be civil servants.

Teacher recruitment policies are established through national legislation, although local education providers can differ in the qualifications they require of teachers. For example, each school must retain a certain number of fixed posts, beyond which it can hire teachers on an hourly wage basis.

Available teaching positions—whether fixed-term or paid hourly—are advertised in national, regional, local, and education-specific newspapers, and on internet. Qualified persons may apply to any such teaching position throughout the country, thereby creating a more flexible teacher labor market. Candidates apply in writing and may undergo tests and interviews, depending on the requirements of the local provider. For the most part, teacher applicants have a good chance of finding employment in Finland.

Teacher education in Finland is provided through 11 universities and five vocational teacher education colleges. Teacher qualifications are earned either directly from education departments and their associated teacher education divisions, or through departments specializing in certain subject areas. These programs produce basic education, kindergarten, subject, and special-needs teachers, as well as counselors, for the entire country.

Applicants to teacher education programs must possess a high school diploma. They are also selected on the basis of their matriculation examination records, grade histories, and relevant work experiences, as well as interviews and essays. Subject-matter teacher applicants apply directly to university departments according to their primary subject, while other types of teachers apply to the teacher education programs themselves. Generally, there is no shortage of teacher education candidates, except in mathematics, natural science, language, and a few vocational subject areas.

Students interested in basic (primary and lower secondary) education typically earn a Master's degree by taking 160 credits over five years. Their education degree includes language and communication, multidisciplinary basic education, main subject and subsidiary subject studies, as well as optional courses. These studies provide knowledge about teacher–student dynamics, holistic student development, and educational theories, as well as practical skills.

Students interested in subject teaching for various schooling levels earn a Master's degree by taking 160 to 180 credits over five to six years. These students focus primarily on their main subject area and can choose to finish a pedagogical component of their teacher education during or after their major degree. Specifically, students must take a minimum of 55 credits in one subject area, at least 35 credits in a second subject, and about 35 credits in pedagogical studies. The pedagogical studies portion for both basic-education teachers and subject-matter teachers includes a practice component that is arranged through the university and its affiliated schools. Some university departments have also begun to offer a degree specifically for subject-matter teacher education, perhaps in order to attract more subject-matter teachers into mathematics and the natural sciences. Because almost all basic- and upper-secondary school teacher applicants earn a Master's degree, they possess fairly strong qualifications for working in occupations outside of teaching.

Students pursuing a degree in vocational education must have prior work experience of at least three years in the field in which they wish to teach. They also take about 35 credits in educational and vocational pedagogy, teaching practice, and the like, and have the option of completing their teaching qualification in one year by studying full-time or in one to three years by studying part-time. Overall, vocational education teachers study for an average of one and a half years and earn a Master's degree or equivalent. Although most vocational teachers have at least three years of work experience when they enter the teaching profession, a significant number of teachers in the labor force have not actually completed the pedagogical studies component.

Because university tuition fees do not exist in Finland, general and vocational teacher education students do not have to pay for their training. However, some teacher education programs have begun to charge fees to potential subject-matter teachers who complete teacher education after obtaining their major degree.

Teacher education programs also allow professionals to enter the teaching field from other occupations. This provision is especially evident for occupations with strong mathematics and science backgrounds, given the growing shortage of teachers in these areas. However, few teachers currently enter by this route. Overall, Finland has put considerable effort into improving mathematics and natural science instruction with the aim of promoting the country's technology and science-based industries. The Ministry of Education in Finland likewise has focused on expanding teacher education programs in mathematics and natural sciences. It has also developed teacher education provision in the areas of basic, special-needs, and language education in order to attract outside professionals to the teaching arena.

When applying for jobs, graduates do not need a separate teacher certificate or teaching practice beyond their university degree. The respective teacher education universities and colleges are thus the institutions primarily responsible for teacher education quality; they are evaluated by the Higher Education Evaluation Council. According to a 2002 study, over 80% of full-time basic-education teachers, over 90% of full-time upper-secondary teachers, and about 75% of vocational education teachers possessed the standard teaching qualifications (Ministry of Education, 2003).

Once settled into their teaching career, teachers receive a minimum of three days of in-service education every year. Local funding authorities often decide on the in-service content. Teachers can also access continuing education opportunities, depending on the locality in which they work and the composition of their surrounding teacher community. Teachers engaged with upper-secondary vocational training receive in-service education as well as time to work with local enterprises to improve their knowledge and skills. A work-based learning period (a half-year minimum) is included in all vocational upper-secondary programs. In recent years, students, teachers, and workplaces have been encouraged to work more collaboratively, an emphasis that enhances the teachers' own professional capacities.

Teacher salaries

Teacher work conditions are negotiated by two organizations: the Trade Union of Education (OAJ), to which approximately 95% of teachers belong; and the Association of Finnish Local and Regional Authorities, which represents the local authorities employing teachers. The national government very occasionally participates in negotiations and thereby assists in determining minimum teacher salary levels, instructional hours, and other work conditions. Policies generally espouse increasing teacher salaries on a moderate and general basis; this practice applies to most teachers in the market. However, a 2003/2004 joint agreement between the above parties resulted in a provision whereby teachers who display strong professionalism and performance receive personal cash bonuses. Local education providers also can and do adjust and improve salary and conditions beyond the negotiated agreements.

Teachers' basic salaries thus increase periodically, and that increase often depends on seniority and the number of classes taught. According to statistics from the Commission for Local Authority Employers (2009), the average total monthly income of basic-education and subject-matter teachers was respectively €2,340 and €2,700 in 2001. For a full-time teacher in a comprehensive school in 2005, the average total monthly income was €3,157. According to 2001 figures from the Confederation of Unions for Academic Professionals in Finland (personal communication), the initial salaries of subject-matter teachers hovered around €1,900, while subject-matter teachers with approximately 20

years of experience earned about €2,700. On average, the total average income a teacher could expect to receive in 2001 comprised the basic salary (71%), various incremental payments (19%), and overtime wages (10%).

Teacher salaries are generally lower than the salaries of other professions in the private sector. Furthermore, as the education level increases, the difference in salaries between private and municipal sectors correspondingly widens. In 2001, state civil servants with a Master's degree earned, on average, about €2,890 per month. This amount was slightly higher than the average salary of teachers teaching a particular subject and €500 more than teachers teaching within basic education. Overall, the pay of Finnish teachers is below the OECD average (OECD, 2003). Santavirta, Aittola, Niskanen, Pasanen, Tuominen, and Solovieva (2001) found that primary and lower-secondary school teachers were working an average of 39 hours per week, regardless of gender, while upper-secondary school teachers were working an average of 42.5 hours per week.

Tables 23 and 24 set out the median monthly earnings (in euros) in 1997 and 2004 for three groups: male and female teachers with Bachelor's and Master's degrees, science and engineering professionals, and associated professionals. The tables show salaries for secondary school teachers only. However, Figures 19 and 20 show earnings for all teachers (including secondary) as well as for science and engineering professionals, excluding associated professionals. Because almost all young teachers now obtain Master's degrees, the figures show the comparative earnings for holders of these degrees only.

Table 23: Finland, Monthly Median Earnings, by Gender, Education, Age, and Occupation, 1997 (1997 euros)

	Males with Bachelor's Degree, 1997			Females with Bachelor's Degree, 1997		
Age	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*
20–24	1,682		1,562	1,630	1,350	1,388
25–29	1,906	1,763	1,774	1,825	1,444	1,514
30–34	2,186	2,049	2,248	1,949	1,578	1,690
35–44	2,456	2,342	2,748	2,241	2,162	1,874
45–54	2,719	2,589	3,117	2,460	2,400	2,004
55–64	2,811	2,637	3,290	1,997	2,436	2,000
	Males with Postgraduate Degree, 1997			Females with Postgraduate Degree, 1997		
Age	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*
20–24	2,018	1,947	1,766	1,934	1,835	1,594
25–29	2,271	1,950	2,037	2,102	1,884	1,850
30–34	2,581	2,099	2,523	2,314	2,057	2,088
35–44	2,973	2,450	3,126	2,607	2,,338	2,456
45–54	3,216	2,834	3,491	2,761	2,617	2,546
55–64	3,448	2,832	3,713	2,857	2,679	2,687

Source: Estimates computed by Statistics Finland from data collected on wages and salaries in Finland (see http://www.stat.fi/tup/suoluk/index_en.html).

Table 24: Finland, Monthly Median Earnings, by Gender, Education, Age, and Occupation, 2004 (2004 euros)

	Males with Bachelor's Degree, 2004			Females with Bachelor's Degree, 2004		
Age	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*
20–24	2,120		2,029			1,794
25–29	2,620	2,361	2,257	2,445	2,212	1,949
30–34	2,864	2,542	2,675	2,635	2,273	2,067
35–44	3,174	2,904	3,358	2,838	2,609	2,168
45–54	3,270	3,166	3,677	3,011	2,998	2,434
55–64	3,399	3,199	3,813	3,185	3,044	2,597
	Males with Postgraduate Degree, 2004			Females with Postgraduate Degree, 2004		
Age	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*	*Science/Eng Profs & Assoc Profs*	*Secondary Teachers*	*All Other Occupations*
20–24			1,814			1,945
25–29	3,015	2,638	2,913	2,790	2,504	2,463
30–34	3,342	2,753	3,500	3,011	2,611	2,764
35–44	3,773	3,059	4,020	3,311	2,896	3,087
45–54	3,947	3,454	4,390	3,464	3,297	3,382
55–64	4,069	3,511	4,548	3,527	3,315	3,339

Source: Estimates computed by Statistics Finland from data collected on wages and salaries in Finland (see http://www.stat.fi/tup/suoluk/index_en.html).

Figure 19: Finland, Monthly Median Earnings of Males with Master's Degree, by Age and Occupation, 2004

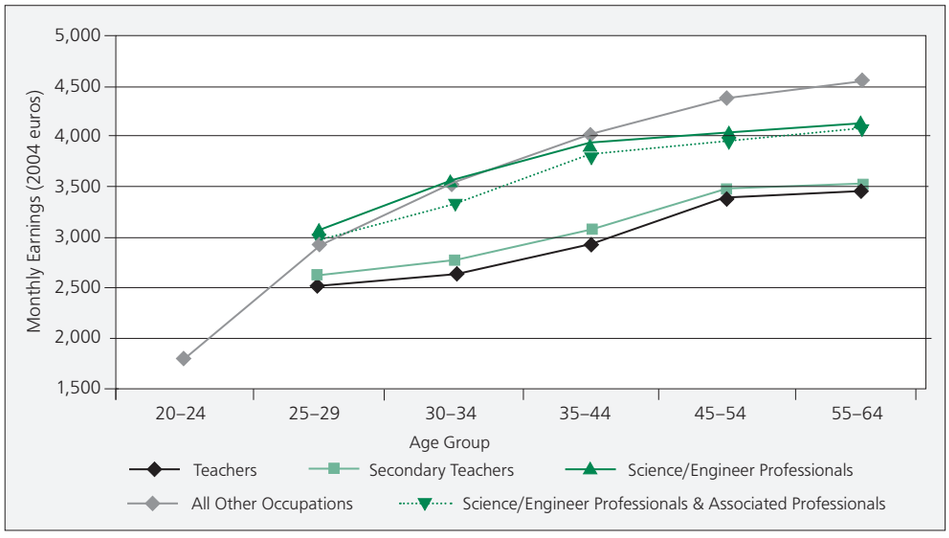
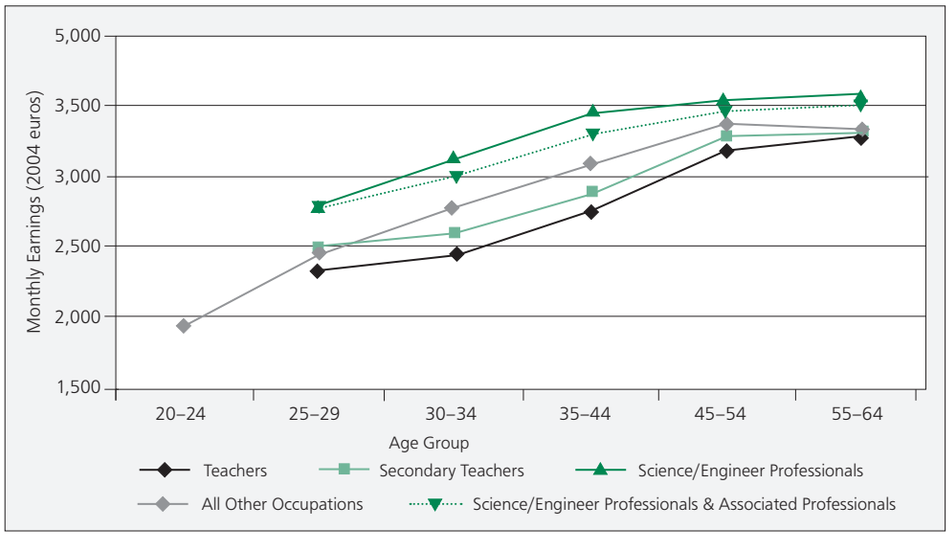


Figure 20: Finland, Monthly Median Earnings of Females with Master's Degree, by Age and Occupation, 2004



What is particularly evident from these data is the widening of the absolute earnings gap between secondary teachers and science professionals between 1997 and 2004, especially for females. Despite an equal proportional increase in salaries across occupations during this period, it seems that teachers are not catching up with the salaries on offer in mathematics-oriented professions. Although the difference of about 15% is substantial, it can be partially offset by the generally lower number of hours that teachers work annually. As in other countries, the difference in earnings between teachers and people in mathematics-oriented professions is much larger for males than for females, explaining why the teaching profession in Finland (as elsewhere) is largely female.

References

Commission for Local Authority Employers. (2009). *Local authority employers in Finland.* Helsinki: Author. Available online at http://www.kuntatyonantajat.fi/index-id-3C33AE32DC744D87AB4ABC847A5C107D.asp.

Ministry of Education. (2003). Memorandum of the working group for teacher demand. In *Working group memoranda and reports of the Ministry of Education* (in Finnish). Helsinki: Author.

Organisation for Economic Co-operation and Development (OECD). (2003). C*ountry background report for Finland on attracting, developing, and retaining effective teachers.* Paris: Author.

Santavirta, N., Aittola, E., Niskanen, P., Pasanen, I., Tuominen, K., & Solovieva, S. (2001). *Nyt riittää. Raportti peruskoulun ja lukion opettajien työympäristöstä, työtyytyväisyydestä ja työssä jaksamisesta (Enough is enough: A report on the work environment, job satisfaction and burn-out of Finnish teachers)* (research report 173). Helsinki: Department of Education, University of Helsinki.

World Bank. (n.d.). *World development indicators.* Washington, DC: Author.

France

Composition of the teacher labor force

Nearly all French primary school teachers are women, but this is not the case for secondary school teachers (Table 25). Although the data we use are for the year 2000, the number of teachers and the proportion of women have changed only slightly since that time. The teacher labor force is also quite elderly, particularly in secondary education, a situation that has implications for recruitment over the next few years (see below). Nevertheless, enrollment in primary school is steadily declining, and enrollment in secondary school appears to have leveled off (Table 26). In 2006 and 2007, France's Ministry of National Education was able to recruit sufficient numbers of new teachers despite high levels of retirement (Ministry of National Education, 2008). The composition of enrollment at public schools could possibly change if immigration from North Africa continues, thus creating new kinds of demands on the education system and its teachers.

Table 25: France, Composition of the Educational Labor Force, 2000

Staff Categories (public education sector)	Numbers 2000	Age Groups in %		% Women	% Part-Time
		Under 30	*Over 50*		
Primary Education Teachers	314,730	12.8	22.6	77.8	6.4
Secondary Education Teachers	420,240	12.5	33.5	56.7	7.5
Higher Education Teachers	71,600	9.0	41.9	33.1	1.3
Trainee Teachers	34,570	72.1	8.0	62.3	0.7
Management/Administrative/ Technical Staff	303,320	22.5	27.1	64.9	17.1
Total	1,144,460	16.8	28.6	63.4	9.2

Source: Ministry of National Education (2001).

Table 26: France, Evolution of Student Enrollments (Public and Private Sectors), 1960 to 2005

School	Year of Enrollment (Number of Students)					
	1960	*1970*	*1980*	*1990*	*2000*	*2005*
Primary (Including Pre-Primary)	6,371,000	7,220,000	7,124,000	6,705,000	6,552,000	6,626,500
Middle and Secondary	3,158,000	4,452,000	5,137,000	5,523,000	5,613,000	5,485,000
Total	9,529,000	11,672,000	12,261,000	12,228,000	12,165,000	12,111,500

Source: Ministry of National Education (2002).

Teacher education and recruitment

In France, the requirements for becoming a teacher are as follows. Applicants must have a licence (completed university) or equivalent degree and studied for a selective entrance examination (the *concours*), either as first-year students in a university institute for teacher education (IUFM) or independently. Once applicants pass the *concours*, they have to spend a second year of training at an IUFM as a paid trainee teacher and pass the associated professional qualification examination. At that point, they become fully qualified teachers and state employees. Their assignment to a particular school and class is determined with reference to a vast "database" that documents assignment of teachers and reassignment of those teachers who want to change posts. Each assignment is conducted by way of a points system that depends mainly on seniority.

For primary school teachers, the *concours* is organized within each region; assignment to a school is done at departmental level. The focus is on multifunctional competencies. Pre-service education is the responsibility of the higher education system, but in-service education is carried out by the education system itself. Secondary education teachers need a university degree in the relevant subject area. The *concours* is organized at the national level and focuses on the particular subject area the applicant wants to teach.

During the 2002 teacher recruitment campaign, the *concours* attracted about 55,000 candidates for the 12,000 posts open in primary education, and almost 93,000 for the 17,200 posts being offered to new secondary education teachers. However, this situation has since reversed because there are now many more teachers retiring than new teachers coming in, particularly at the secondary level (Cros & Obin, 2004). The Inspectorate General of National Education and the Inspectorate General of Finance earlier estimated that the bulk of retirements would occur around 2003/2004 in primary education and in 2007/2008 in secondary education (Cros & Obin, 2004).

From as early as 1997, there were signs of the upcoming difficulties, with university enrollments beginning to decline in that year, and likewise initial enrollments at the IUFMs. The government therefore put in place a number of incentives to attract young people to teaching. These included:

- Career advantages specifically for teachers;
- Financial bonuses equivalent to a one-year minimum wage for those teachers preparing to sit the *concours*, in exchange for a commitment to teaching if they pass the examination;
- A program to identify potential teachers in the first two years of university education;
- Establishing a network of IUFMs to allow teaching candidates to transfer to schools with a shortage of teachers;
- Adjusting salaries so that rates of pay recognize previous non-teaching experience;
- Modifying the policy that newer teachers are assigned to the tougher classes;
- Conducting intensive European teacher exchanges; and
- Attempting to make the teaching profession more appealing by casting teachers as intellectuals, doers, and managers.

France was able to maintain its teaching force in the early and mid 2000s. However, a new government, elected in 2007 on a platform of making the public sector more efficient, and the economic crisis of late 2008 combined to create a different dynamic. Reforms have been introduced to reduce the teaching force in France. More than 10,000 teaching jobs were cut in 2008 and another 13,000 in 2009.[11]

11 See http://www.guardian.co.uk/education/2008/oct31/france-baccalaurate-sarkozy-strike.

Teacher salaries

Some studies that compare salaries for teachers with salaries for other professionals have found that male teachers in France earn 20% less on average than private-sector employees with the same qualifications. Women teachers earn on average the same as women in private enterprise. However, the working hours are very different. A secondary teacher works 1,340 hours annually, on average, and a senior manager in the private sector works just over 2,000 hours annually (Cros & Obin, 2004).

We estimated teacher salaries in France in 1995 and 2002 from the French employment survey. Although the number of observations in the employment surveys was small in some categories, our analysis suggested that mean monthly earnings for engineers and scientists rose between 1995 and 2002, but that teachers' salaries did not. So, despite the emphasis on recruiting more teachers into the teacher labor pool, it may have made less sense, on the salary front, to go into teaching in 2002 than it made seven years earlier (Table 27). Figures 21 to 24 show the median monthly earnings for these same occupations. Again, the figures appear to show that teachers had become somewhat worse off in relative terms by the early 2000s, and that the differences in median monthly earnings were considerable.

Table 27: France, Mean Monthly Earnings, by Age, Occupation, and Gender, 1995, 2002 (current francs)

Age	Primary Teachers	Secondary Teachers	Scientists	Engineers
Males, 1995				
25–29	9,782	10,500	10,616	11,643
30–34	14,440	21,900	13,673	15,324
35–44	19,486	14,833	16,425	23,310
45–54	19,994	13,735	20,287	19,040
55–64		24,935	25,037	
Females, 1995				
25–29	10,915	9,400	8,300	11,845
30–34	11,289	9,367	17,500	13,953
35–44	12,182	11,655	13,600	17,411
45–54	11,100	13,660	16,750	18,837
55–64			13,000	24,000
Males, 2002				
25–29	7,821		8,000	14,801
30–34	9,000	12,300	12,000	17,269
35–44	17,940	11,452	23,468	20,569
45–54	12,908	19,703	22,536	22,879
55–64		13,367	27,979	24,123
Females, 2002				
25–29	8,661	7,683		13,546
30–34	9,950	7,775	11,000	17,573
35–44	11,022	8,684	14,097	18,487
45–54	12,304	14,511		19,256
55–64	14,402	13,593	14,000	27,500

Source: Estimates based on data supplied to the authors by the National Institute of Statistics and Economic Studies, from the quarterly Survey of Enterprises on Employment and Wages, 1995, 2002.

Figure 21: France, Median Monthly Earnings of Males with First-Cycle Education, by Age and Occupation, 1995

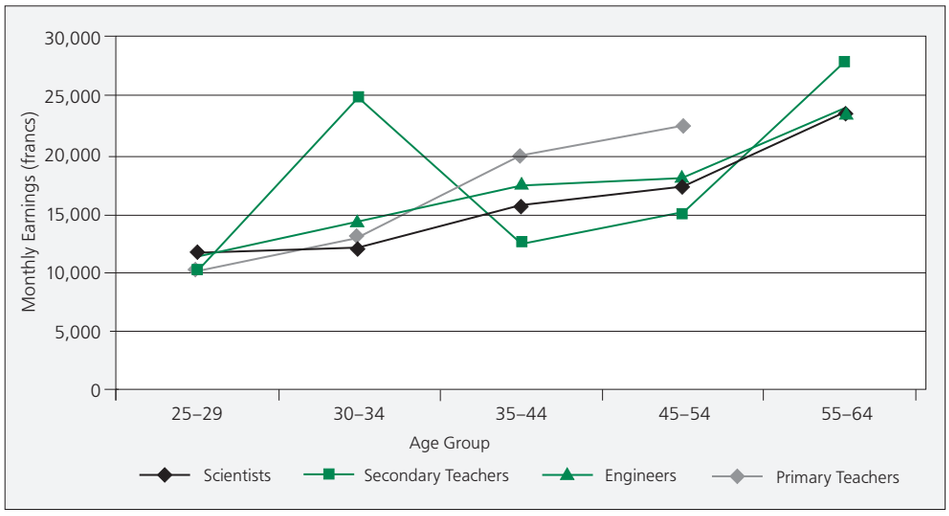


Figure 22: France, Median Monthly Earnings of Females with First-Cycle Education, by Age and Occupation, 1995

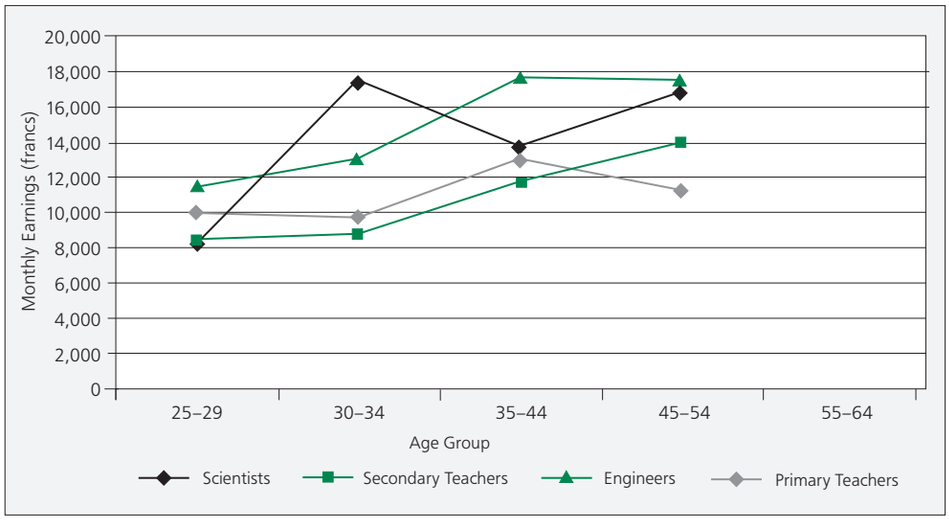


Figure 23: France, Median Monthly Earnings of Males with First-Cycle Education, by Age and Occupation, 2002

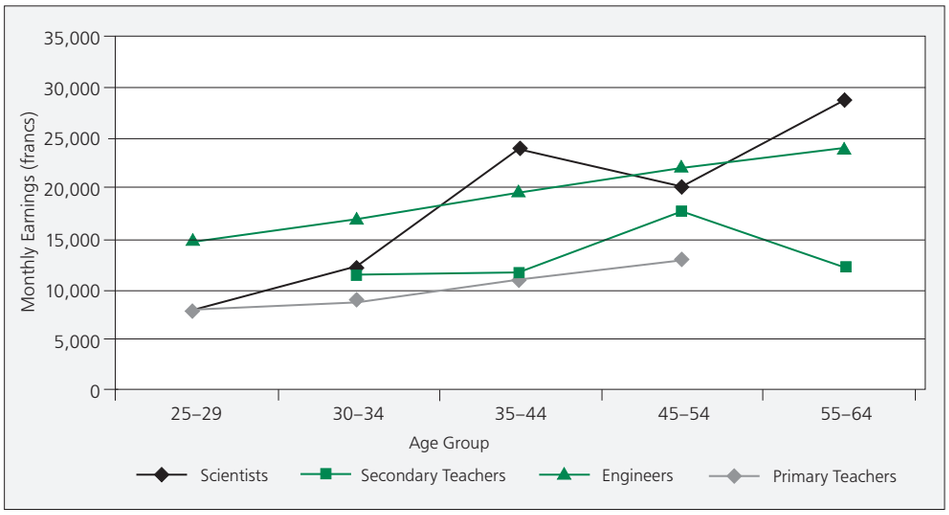
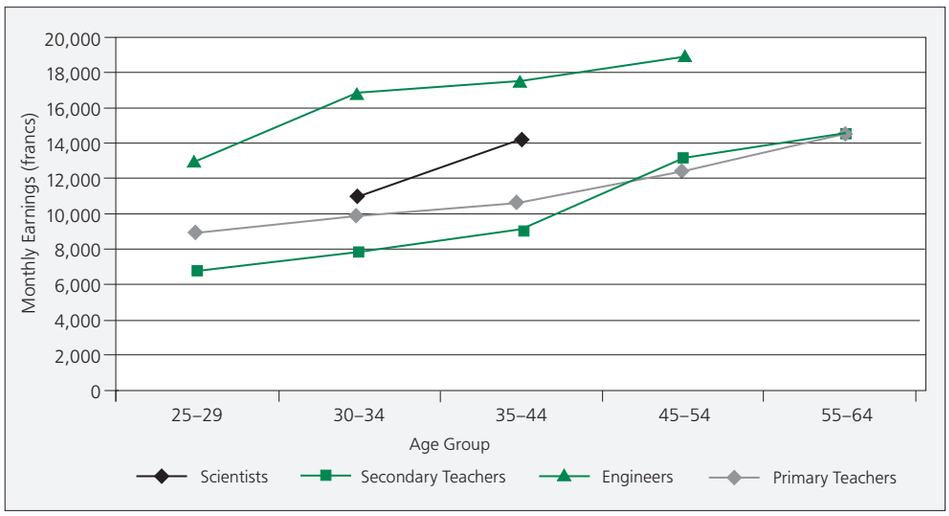


Figure 24: France, Median Monthly Earnings of Females with First-Cycle Education, by Age and Occupation, 2002



References

Cros, F., & Obin, J-P. (2004). *Attracting, developing, and retaining effective teachers: Country background report for France*. Paris: Organisation for Economic Co-operation and Development (OECD).

Ministry of National Education. (2001). *Note d'information (Information note) 01-40 (August)*. Paris: Author. Ministry of National Education. (2002). *Repères et références statistiques (Statistical references and notes)*. Paris: Author.

Ministry of National Education. (2008). *Repères et références statistiques (Statistical references and notes)*. Paris: Author.

Germany

Education system

The German education system today is a combination of the West German (Federal Republic of Germany) and the East German (German Democratic Republic) systems. Teachers in both the FRG and the GDR were trained in a dual system 40 years ago. *Gymnasium* teachers trained in universities, and their focus was subject matter. Other teachers trained in teacher education colleges, which had lower entry requirements than the universities and a heavier emphasis on pedagogy. In the late 1960s, the teacher education colleges were absorbed into existing universities or formed nuclei of new universities in the FRG, but the traditional system continued in the GDR until the early 1990s, when the GDR joined with the FRG.

Composition of the teacher labor force

Across the education system, just over 80% of primary teachers are females, but this figure declines to 60% in the lower-secondary schools and 43% in the upper-secondary schools. The teacher labor force in Germany is, on average, much older than in any other country in our sample, except Italy at the secondary level. In 2003, almost 50% of German teachers in primary schools and about 56% of teachers in secondary schools were over 50 years of age. Because the number of primary school students is gradually declining, teacher age distribution presents less of a problem at that level. However, secondary enrollment is still increasing, so replacement and growth of the teacher labor force may be an issue in coming years, especially since, as we shall show, teachers' relative salaries appear to be declining.

Teacher education

Generally, teachers have to have a solid foundation in subject-matter studies, which they study in the university departments specializing in the respective subjects. General educational studies are often supplemented by specializations, such as teaching reading, studied by prospective reading specialists at the primary school level.

The states, or *lander*, are responsible for teacher certification, as well as for curricula and choice of textbooks. According to the *International Encyclopedia of Education* (Husén & Postlethwaite, 1995, p. 2477), "University (or teacher training college) studies are concluded by a state-supervised examination with university staff functioning as examiners. This is followed by an internship (*referendariat*), which includes supervised teaching practice and additional coursework. This *referendariat* lasts two years, at the end of which there is a second examination run solely by the state."

West German teachers often did not begin teaching until they were almost 30 years old. In the former GDR, the requirements were much less demanding, which meant that a typical primary teacher began teaching in his or her early 20s. With reunification, many GDR teacher trainers, researchers, curriculum specialists, and school principals lost their positions because of their cooperation with the Ministry of State Security. Reunification also led to all five East German states adopting the education systems of the West, including teacher education (Halasz, Santiago, Ekholm, Matthews, & McKenzie, 2004).

All analysis of the German teacher labor market is complicated by reunification. Although the remuneration that GDR teachers now receive is generally the same as that received by FRG teachers, labor is completely mobile between the two parts of Germany (at least in principle), so the question of whether other *lander* will accept GDR-trained teachers looms large in understanding how the supply of teachers was affected by reunification.

As in the United States, the situation is also complicated by the decentralization of educational financing to the German states (except for the tertiary education system, which is partially funded nationally). To the degree that German states vary in how much they spend per student and how much they pay teachers, national data hide variation among states.

Teacher salaries

The widely held view of German teachers is that they are well paid and well respected. Our results from analyzing household surveys in 1990, 1995, and 2000 suggest that the view may be based on old information. We need to point out that these household surveys involve samples, and that once we divided the income data into age groups, gender, education level, and occupation, the number of observations in some cells was quite low, resulting in less than straightforward age–income profiles. Average annual incomes also reflect the inclusion of part-time as well as full-time workers. Also, many social scientists work in financial institutions and other financial services, not in traditional research or academic jobs: their pay is more a reflection of the sector they work in than a reflection of their academic preparation.

With these caveats taken into account, Table 28 shows the annual earnings of teachers, scientists, and social scientists by gender and age group. The earnings in the table are combined for three education levels: 13 to 15 years of schooling, thus including some years of university; 15 to 16 years of schooling, denoting even more years of university study; and 17 to 18 years of schooling, which implies some graduate work. Wages vary little for scientists across these different levels of education, and most teachers have at least 15 years of schooling. Secondary school teachers tend to have 17 to 18 years of education. Table 28 also shows that, in the early 1990s, teachers appeared to do well, income-wise, relative to scientists, and this was particularly true for male teachers. However, in the second half of the 1990s, the opposite happened, especially for younger teachers. Their relative salaries showed a decline when compared to the salaries of workers in "competing" professions.

Figures 25 to 28 confirm this late 1990s' trend. Hourly earnings for young male teachers with higher levels of education (17 to 18 years) declined relative to the earnings of scientists with higher levels of education, as did the hourly earnings of young female teachers, although the decline was compensated for by a relative rise in older teachers' hourly earnings. (The level of education is controlled for in the hourly earnings estimates.)

The results for Germany present a situation in which teacher salaries are highly competitive with salaries in mathematics-intensive professions, although this situation may be changing, especially in terms of salaries for younger teachers. This trend may reflect a shift in policy regarding teacher pay and raises the question of whether declining relative salaries for teachers will affect recruitment of teachers with reasonably high-

Table 28: Germany, Annual Earnings of Teachers, Scientists, and Social Scientists, by Gender and Age, 1990, 1995, 2000 (current euros)

	Males with University Education, 1990			Females with University Education, 1990		
Age	*Teachers*	*Scientists*	*Social Scientists*	*Teachers*	*Scientists*	*Social Scientists*
20–24	22,131	19,222	20,835	15,666	16,051	14,749
25–29	24,987	21,583	27,601	10,048	19,028	18,517
30–34	34,273	32,564	30,870	19,940	23,908	21,428
35–44	38,276	27,585	42,423	29,837	21,789	24,444
45–54	37,123	32,398	36,744	34,658	19,936	22,571
55–64	22,131	29,477	20,835	32,347	30,715	38,841
	Males with University Education, 1995			Females with University Education, 1995		
Age	*Teachers*	*Scientists*	*Social Scientists*	*Teachers*	*Scientists*	*Social Scientists*
20–24	35,525	20,130	21,591	22,926	18,906	17,382
25–29	21,379	26,024	28,677	21,769	23,005	23,117
30–34	37,076	31,672	30,868	24,525	21,781	19,207
35–44	42,398	32,157	37,922	27,634	26,094	29,666
45–54	45,528	38,344	41,174	33,532	29,389	28,446
55–64	35,525	39,594	50,594	29,193	49,953	28,385
	Males with University Education, 2000			Females with University Education, 2000		
Age	*Teachers*	*Scientists*	*Social Scientists*	*Teachers*	*Scientists*	*Social Scientists*
20–24		21,790	23,200	19,321	24,052	21,916
25–29	14,667	27,004	26,643	21,168	29,685	23,983
30–34	20,044	37,600	37,936	30,227	32,028	30,919
35–44	31,437	39,261	46,763	31,133	30,809	32,480
45–54	44,777	40,322	43,427	34,261	26,927	32,902
55–64	49,466	42,121	50,845	39,440	23,547	34,811

Source: Estimates from data made available to the authors by the German Economics Institute's German Socio-Economic Panel Study (GSOEP) for 1990, 1995, and 2000, with the cooperation of Cornell University's College of Human Ecology, Department of Policy Analysis and Management.

level mathematics skills into middle and high schools. In addition, the fact that relative salaries were so high in the past (and the very strong preparation that German student teachers receive in mathematics) suggests that the relatively poor performance of German students on PISA 2003 is probably not because of teachers with low mathematics skills but because of structural problems in the German education system. However, if the salary trends we show here are accurate, the favorable salary of German teachers may be deteriorating, meaning that the previously advantaged situation regarding the mathematics skills of Germany's teachers could also change.

Figure 25: Germany, Hourly Earnings of Males with 17 to 18 Years of Education, by Age and Occupation, 1995

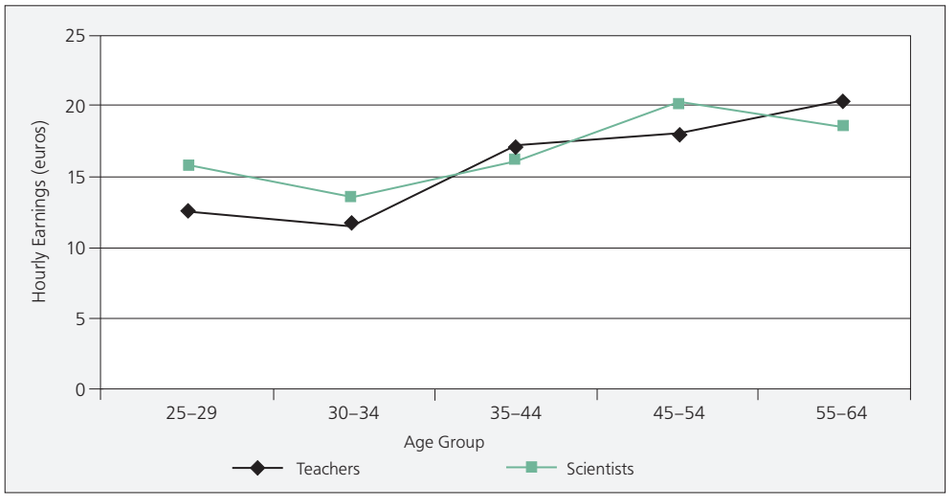


Figure 26: Germany, Hourly Earnings of Females with 17 to 18 Years of Education, by Age and Occupation, 1995

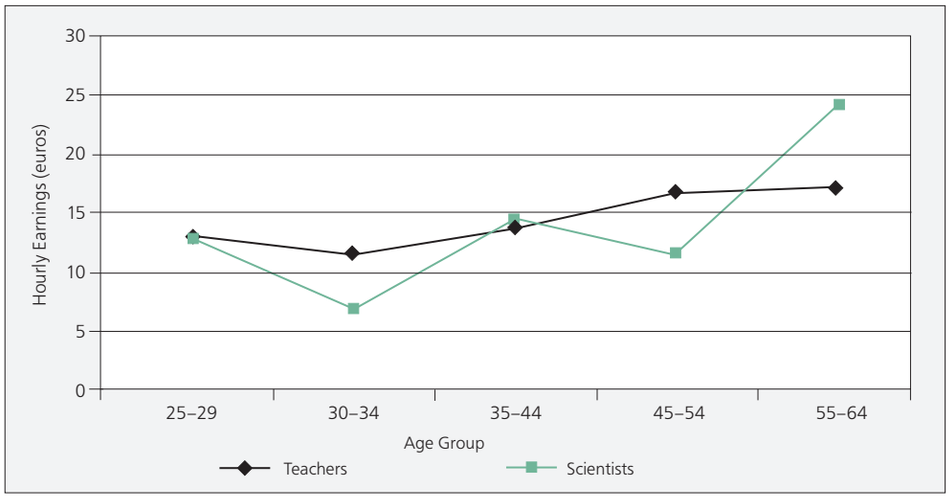


Figure 27: Germany, Hourly Earnings of Males with 17 to 18 Years of Education, by Age and Occupation, 2000

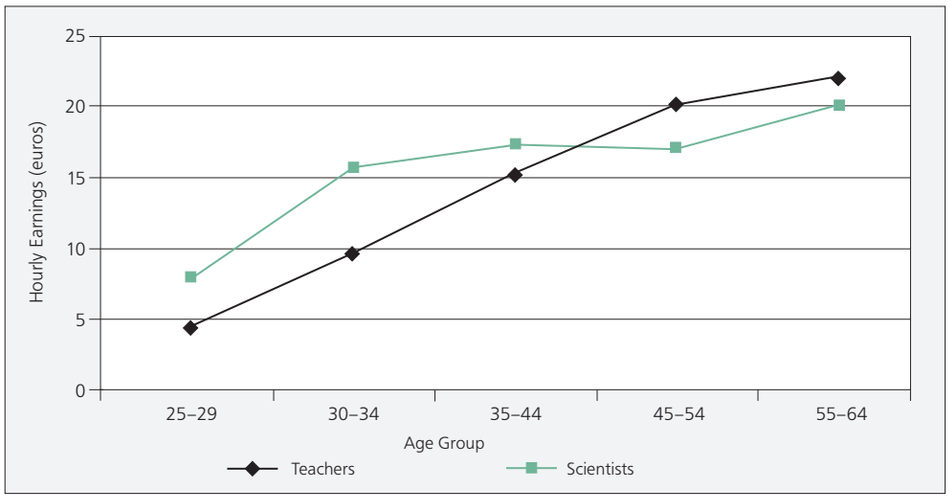
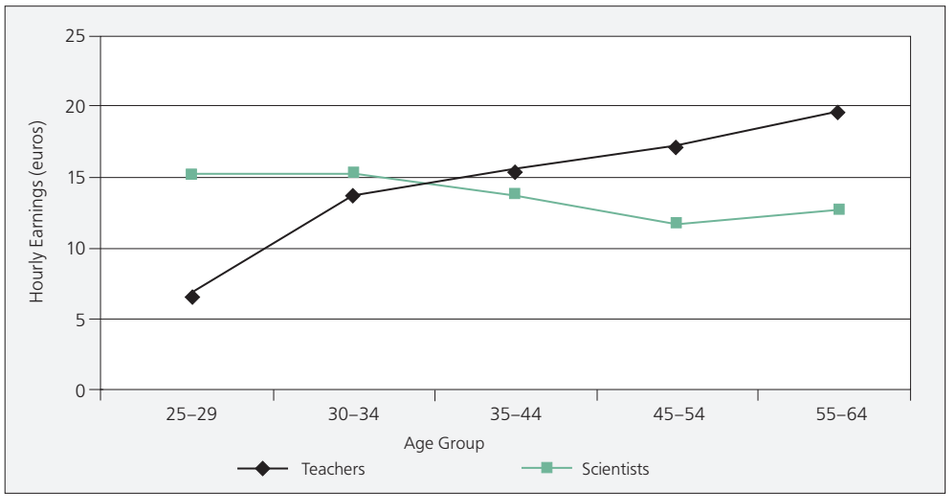


Figure 28: Germany, Hourly Earnings of Females with 17 to 18 Years of Education, by Age and Occupation, 2000



References

Halasz, G., Santiago, P., Ekholm, M., Matthews, P., & McKenzie, P. (2004). *Attracting, developing, and retaining effective teachers: Country background report for Germany*. Paris: Organisation for Economic Co-operation and Development (OECD).

Husén, T., & Postlethwaite, N. (1995). *The international encyclopedia of education*. Oxford: Pergamon.

Organisation for Economic Co-operation and Development (OECD). (2005). *Education at a glance*. Paris: Author.

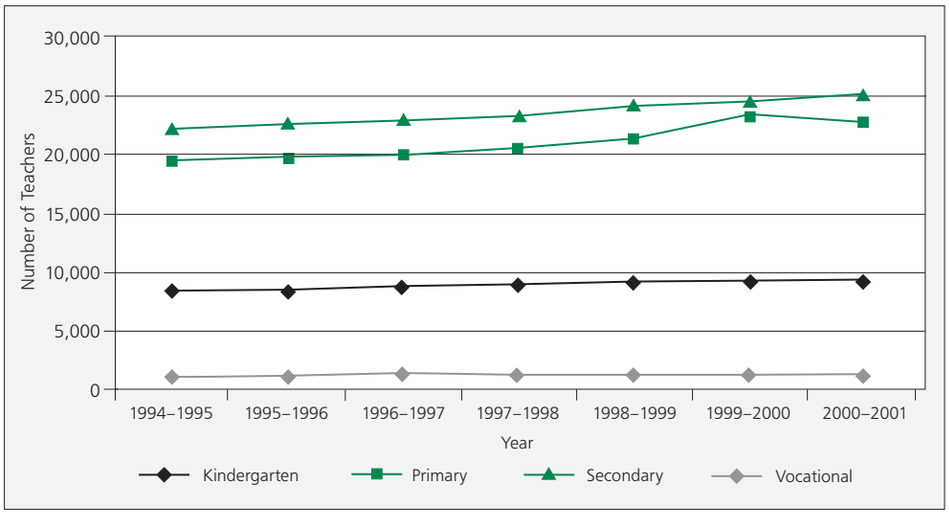
Hong Kong SAR

Composition of the teacher labor force

The number of primary and secondary school teachers in Hong Kong increased steadily during the 1990s (Figure 29). Although the number of secondary school teachers is expected to continue to rise, the decline in the number of children in the population began to affect the size of the kindergarten and primary school labor force in the early 2000s.

Nearly all teachers in Hong Kong are university trained. About three-quarters of primary school teachers and 92% of secondary school teachers have a Bachelor's or higher degree. Of those who teach in government and aided schools, almost all have trained as teachers. About 20% of private primary school teachers have not received pre-service education (Lai, 2006, Table 1). In total, about 70% of primary teachers have a university degree and are trained. The corresponding figure for secondary schools is 88%. The subjects with the highest percentages of degree holders in primary schools are English (79%) and information and communication technology (ICT) (78%). In secondary schools, nearly all the teachers of economics, English, and senior secondary science subjects, such as biology, chemistry, and physics, have degrees. About 55% of teachers in the 1990s were females (Chung & Hung, 2001).

Figure 29: Hong Kong SAR, Number of Teachers, by Level of Education, 1994 to 2000



According to various studies, the quality of new entrants into the teaching profession in Hong Kong is not as high as the quality of entrants into other professions. Lai, Chan, Ko, and So (2005) show that senior secondary school students consider that people who enter the teaching profession do not have high academic standing. This perception is borne out by the fact that the examination grades of new students admitted into teacher education programs are, on average, lower than those of students admitted to other university faculties (Lai, 2006).

An important issue in Hong Kong is "out of field" teaching. According to Lai (2006), many teachers in Hong Kong teach outside their subject field, and this is particularly true in subjects for which there is a short supply of qualified teachers.

> For instance, only 46% and 55.7% of the English language teachers in primary and secondary schools respectively were classified by the Education Department as "subject-trained" in 1996 (see Measure 1 [Lai, 2006, Table 3] below). It was only in the past few years that the government and the community have become concerned with this problem. Such an interest has largely arisen from two policy developments—first, the government's quest for "highly qualified" language teachers and second, the government's advocating of specialist teaching in three core primary school subjects, i.e. English language, Chinese language and mathematics. With the more stringent requirements, many language teachers who were previously considered as "qualified" are now categorized as "under-qualified" or "out-of-field." (Lai, 2006, p. 10)

Teacher education

Until recently, the minimum qualification an individual needed to teach in primary and secondary schools was a secondary school graduation certificate. Since 2004, new teachers have been required to hold a post-secondary diploma (two years of post-secondary schooling). However, the majority of teachers in Hong Kong, as discussed above, hold either a Bachelor's or a subsequent degree.

In 1994, pre-service teachers in Hong Kong began studying in four government-funded institutions. These include three comprehensive universities, which train mostly senior secondary school teachers, and the Hong Kong Institute of Education (HKIEd), which trains mostly primary and junior secondary school teachers. Secondary school teachers all major in an academic subject and take an additional year of professional training in education. All programs include a practice teaching period of 14 to 16 weeks (Lai, 2006).

The government has been increasing its focus on standards in the teaching profession. According to Lai (2006, p. 6), "The government has issued numerous reports, policy papers and speeches urging principals and teachers to actively participate in professional development, which is seen as crucial to the success of the education reform. In particular, the government has taken an active role in setting policies to raise the academic and professional standards of language teachers." The government decided to raise language proficiency requirements in 2000 for English and Mandarin teachers in both primary and secondary schools. However, because of objections from the teachers' union, the government had to compromise and grant exemptions to teachers who already had a degree major in the relevant language subject; teachers could also meet the requirement through in-service education rather than through testing.

For many years, Hong Kong did not have in place a systematic professional development program for its teachers. In 2003, a government consultative committee recommended that all teachers engage in professional development activities for at least 150 hours over a three-year cycle. Although the recommendations were not mandatory, job security concerns occasioned by falling enrollment in primary schools pushed teachers to enroll in professional development courses (Lai, 2005).

Teacher recruitment and hiring

People who want to teach in Hong Kong have to apply to the Education and Manpower Bureau for registration as a "registered" or a "permitted" teacher. To qualify for registration as a registered teacher, a person has to have obtained "qualified-teacher" status by completing an approved teacher education program offered by a recognized institution. Schools can employ people without a recognized teacher qualification as a permitted teacher.

The Education and Manpower Bureau attempts to control the supply of qualified teachers by fixing the number of students that recognized universities and the HKIEd can admit each year. Because these programs are highly subsidized, the bureau has an interest in underestimating market needs, so there is usually a shortage of qualified teacher graduates. As a result, a relatively high percentage of teachers in Hong Kong schools are permitted teachers. In the mid 1990s, even with the stabilized demand for new teachers and the expansion of teacher education capacity to allow permitted teachers to obtain their "qualification," the percentage of permitted teachers was still 15% in primary schools and 25% in secondary schools (Lai, 2006).

A longitudinal study of teachers in the 1990s (Chung & Hung, 2001) showed that of 2,068 new entrants into the teaching force in 1991, only 55% were still teaching in 1999, a retention rate of about 55%. The study found that initial pre-service education had a positive impact on retention: those teachers with higher levels of education were more likely to remain in teaching, as were mathematics and science teachers; English teachers were the teachers most likely to leave. Also, on-the-job in-service training was the most effective way of retaining teachers. This factor mainly applied to untrained university graduates who undertook in-service education to upgrade their teaching status (Chung & Hung, 2001).

Teacher salaries

Teachers in Hong Kong are relatively well paid. Yue-Ping Chung of the Chinese University of Hong Kong made special estimates for this study of the mean monthly incomes from household surveys of teaching and non-teaching professionals as well as of managers/administrators who had majored in mathematics and science. The surveys were conducted in 1996 (before the Asian financial crisis) and 2001 (after the crisis and when GDP per capita had fallen from the highs of 1997).

Tables 29 and 30 and Figures 30 to 33 show that male teaching professionals who were mathematics and science majors (these individuals tend to be secondary school teachers) earned almost as much in 1996 as mathematics and science professionals who were not teachers, and they earned more at higher ages. Mathematics and science teachers also earned more than managers/administrators. This pattern was less evident for teachers who had majored in education (primary school teachers).

By 2001, the earnings of managers/administrators who had majored in mathematics and science had risen relative to other groups, including teachers. Both male and female managers/administrators earned more than teaching and non-teaching professionals, but teachers continued to do better economically than non-teaching professionals who had majored in mathematics and science.

This pattern suggests that teaching, from an economic standpoint, and despite studies showing that students regard teaching as a low-status profession and that teaching as a career often attracts lower scoring high school and college students, should be a relatively attractive career. Moreover, mathematics and science majors who enter secondary teaching, and even education majors entering primary teaching, are paid relatively high salaries. The fact that male teachers do well compared to other professions also helps explain the relatively high proportion of male teachers in Hong Kong (about 45%).

Table 29: Hong Kong SAR, Mean Monthly Earnings, by Gender, Age, Occupation, and College Major, 1996 (HK dollars)

Male Monthly Earnings, 1996				
Age	*Teaching Profs (Mathematics & Science Majors)*	*Non-teaching Profs (Mathematics & Science Majors)*	*Managers & Administrators*	*Teaching Profs (Education Majors)*
20–24	14,472	11,623		
25–29	26,492	18,854	25,324	20,092
30–34	29,793	31,254	28,154	30,108
35–44	42,205	45,963	42,327	34,328
45–54	46,827	38,476	40,888	36,099
55+	43,977	17,510	27,213	23,609
Male Monthly Earnings, 1996				
Age	*Teaching Profs (Mathematics & Science Majors)*	*Non-teaching Profs (Mathematics & Science Majors)*	*Managers & Administrators*	*Teaching Profs (Education Majors)*
20–24	14,283	11,000		13,643
25–29	20,672	15,772	27,269	20,011
30–34	30,960	27,322	31,828	20,794
35–44	30,816	31,139	27,308	31,152
45–54	32,299	18,850	29,357	31,754
55+	18,393		27,325	25,670

Source: Earnings estimates prepared for this study by Yue-ping Chung, Department of Education, Chinese University of Hong Kong, using information from the 1996 Hong Kong Population Census database (Government of the Hong Kong SAR Census and Statistics Department).

Table 30: Hong Kong SAR, Mean Monthly Earnings, by Gender, Age, Occupation, and College Major, 2001 (HK dollars)

Female Monthly Earnings, 2001				
Age	*Teaching Profs (Mathematics & Science Majors)*	*Non-teaching Profs (Mathematics & Science Majors)*	*Managers & Administrators*	*Teaching Profs (Education Majors)*
20–24	10,200	12,435	17,750	18,294
25–29	22,020	20,078	24,114	23,201
30–34	34,135	27,433	39,388	31,231
35–44	50,793	46,632	58,102	43,335
45–54	58,829	51,544	62,278	54,247
55+	78,865	37,661	43,464	65,875
Female Monthly Earnings, 2001				
Age	*Teaching Profs (Mathematics & Science Majors)*	*Non-teaching Profs (Mathematics & Science Majors)*	*Managers & Administrators*	*Teaching Profs (Education Majors)*
20–24	12,734	12,591		15,461
25–29	22,197	16,705	24,400	21,844
30–34	29,652	26,520	41,819	28,900
35–44	43,414	33,440	64,787	35,098
45–54	44,774	32,004	45,646	42,665
55+	12,734	17,422	15,154	43,563

Source: Earnings estimates prepared for this study by Yue-ping Chung, Department of Education, Chinese University of Hong Kong, using information from the 2001 Hong Kong Population Census database (Government of the Hong Kong SAR Census and Statistics Department).

Figure 30: Hong Kong SAR, Mean Monthly Earnings of Male Mathematics and Science Majors, by Age and Occupation, 1996

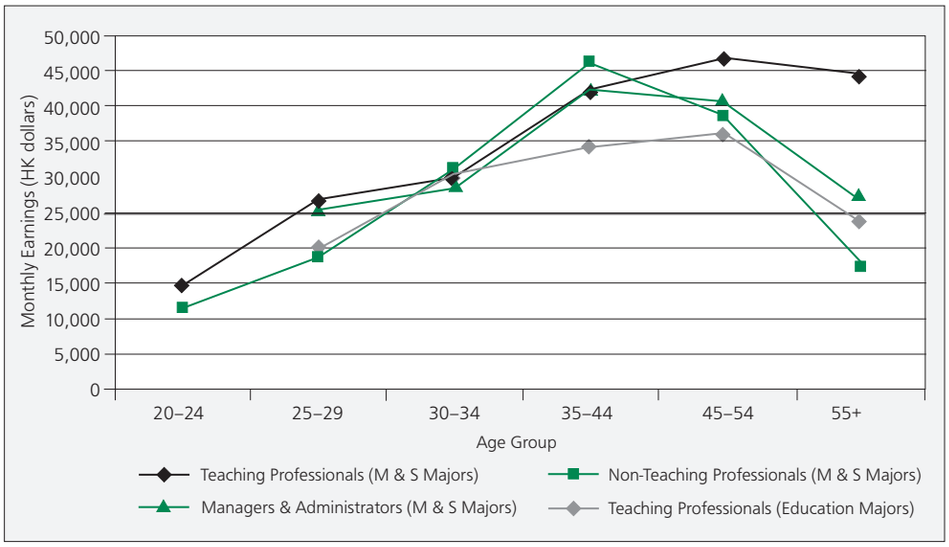


Figure 31: Hong Kong SAR, Mean Monthly Earnings of Female Mathematics and Science Majors, by Age and Occupation, 1996

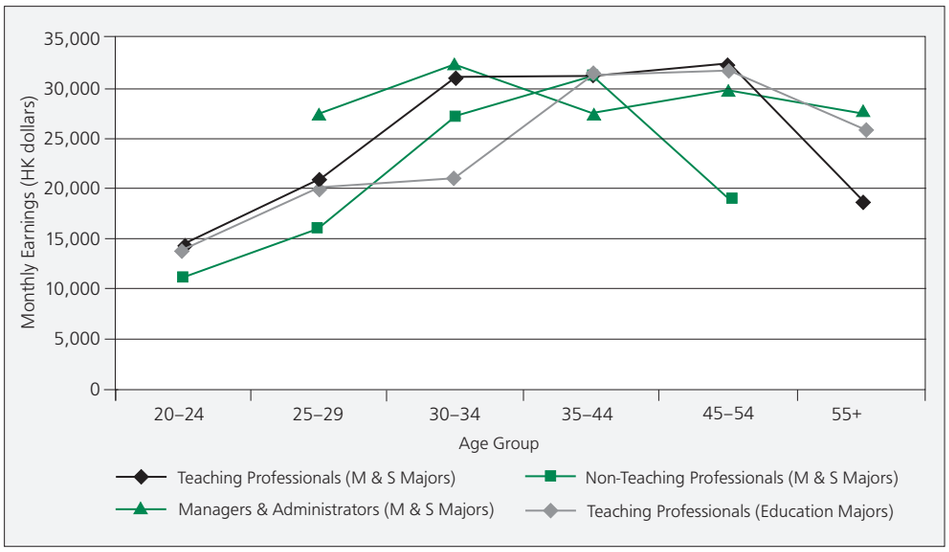


Figure 32: Hong Kong SAR, Mean Monthly Earnings of Male Mathematics and Science Majors, by Age and Occupation, 2001

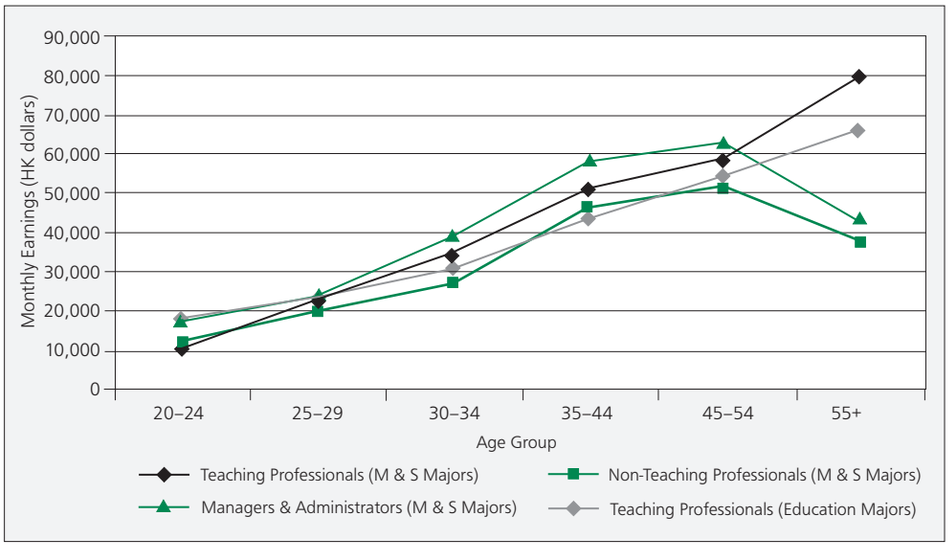
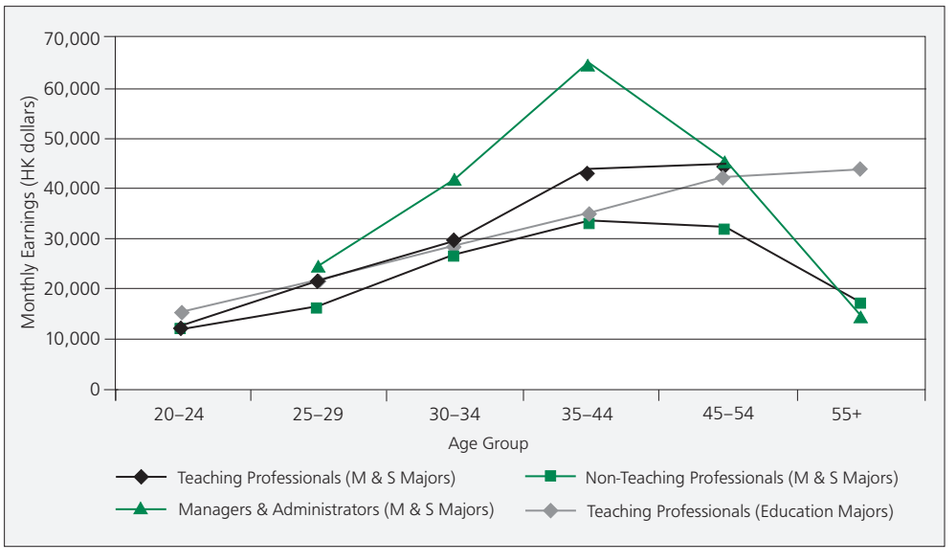


Figure 33: Hong Kong SAR, Mean Monthly Earnings of Female Mathematics and Science Majors, by Age and Occupation, 2001



References

Chung, Y.-P., & Hung, F. S. (2001). *Teacher supply in Hong Kong: Educational qualifications and growth*. Paper presented at the Comparative and International Education Society annual meeting, Washington, DC, March 2001.

Lai, K. C. (2005). Bureaucratic control and the professionalisation of Hong Kong primary teachers. *New Horizons in Education, 51*, 1–8.

Lai, K. C. (2006). *Qualifications of the teaching force in the Hong Kong Special Administrative Region, China*. Hong Kong: Hong Kong Institute of Education.

Lai, K. C., Chan K. W., Ko, K. W., & So, K. S. (2005). Teaching as a career: A perspective from Hong Kong senior secondary students. *Journal of Education for Teaching, 31*(3), 153–168.

Italy

Composition of the teacher labor force

In 2002, there were 830,648 Italian teachers working in preschool through upper-secondary education. The largest share of teachers (33%) was working in upper-secondary education. Twenty-four percent were working in lower-secondary schools, 32% in primary schools, and 11% in preschools.

While decreasing population growth in Italy has resulted in falling student enrollments at most levels of the system, the number of teachers has actually grown. For example, between 1980 and 2002, the number of Italian students decreased by 22.1% but the number of teachers increased by 4.8%. As a result, the ratio of students to teachers decreased by 25.6% during the same period. Differences between falling enrollments and increasing numbers of teachers were particularly strong at the primary level, where enrollments decreased by 38% while the number of teachers increased by 3.5%, resulting in a 27.2% decrease in the student–teacher ratio. At the lower-secondary level, the number of students decreased by 38.6% between 1980 and 2002, while the number of teachers also decreased, but by 24.1% (Drago, Basaglia, & Lodolo, 2003).[12]

While growth in the number of teachers was initially caused by increases in student attendance during the 1960s and 1970s, continued growth of the teaching force more recently has stemmed from changes in policies regarding class sizes, access of students with disabilities to full-time teachers, increases in subject offerings in vocational and technical education, and other policies. Changes in the teacher pension system, which encouraged more senior teachers to retire, also opened up new teaching posts in many schools. However, falling population growth, combined with the dissolution of many small, decentralized schools, has dampened demand for teachers in most subject areas.

Despite the increasing number and decreasing demand for Italian teachers, Italy continues to experience periodic shortages of teachers in certain regions and subject areas. Italy's border provinces traditionally are difficult to staff, and demand for teachers in these regions is strong. Teachers with backgrounds in mathematics and science, and in subjects that have been added because of curricular reform in vocational and technical education, are also in short supply. Consequently, these teachers often have a wide range of choice as to where to teach available to them.

A huge share of pre-primary and primary school teachers (99.5% and 95.3%, respectively) are women. Although the proportion of female teachers drops in lower-secondary schools (75.2%) and upper-secondary schools (59.6%), women constitute the majority of teachers at all levels. Perhaps, more surprisingly, the proportions of women on waiting lists for appointments to lower-secondary schools (79.3%) and upper-secondary schools (76.6%) are even higher, indicating increasing feminization of the teaching force.

12 Much of the information reported here about the Italian teacher labor force comes from the study by Drago and colleagues. Unless we indicate otherwise, readers can assume that figures are drawn from this study.

Teacher candidates on lists awaiting assignment are also considerably younger than those currently in service: 65% of applicants are between the ages of 30 and 45, compared to only 41% of practicing teachers in the same age range. Furthermore, 56% of practicing teachers are 45 years of age or older, suggesting a wave of retirements in the near future. Between 1996 and 2006, approximately a third of all teachers retired, compared to the European average of one-fifth.

The breakdown of subject areas among prospective teachers on applicant lists also suggests continuing shortages of secondary-level mathematics and science teachers. In 2003, just over 10% of applicants were from the natural sciences, 8% were from mathematics or physics, and nearly 5% had technology-related backgrounds. In contrast, just under 15% had backgrounds in foreign languages, 20% were from the arts, and 9% had studied economics and/or law.

It is also worth noting that teachers from the south of Italy and the Italian islands make up a disproportionate share of the teacher workforce. Because of the limited number of positions in these areas, many teachers must relocate in order to find teaching jobs. Consequently, geographical mobility among teachers is an important policy issue because displaced teachers who are able to find jobs in their home regions leave their current schools. Many teachers in smaller towns and rural areas also hope to move to larger urban centers. During the 2000/2001 school year, almost 200,000 Italian teachers applied to change either their location or the subject they taught. Of those 200,000, 30% were able to make the requested changes.

Teacher education

Traditionally, Italian teachers in pre-primary and primary schools were required to earn degrees from secondary-level normal schools and institutes. However, a 1998 law required that these teachers have at least university-level degrees in primary teaching. The new Bachelor's-level degree consists of approximately four years of course work, or a minimum of 240 credits. The degree program has two tracks—pre-primary teaching and primary school teaching. Since 2000, secondary-level teachers have had to complete a university degree in their subject and a postgraduate specialization, which focuses on the teaching of specific subjects. Activities directed toward the specialization consist of approximately 120 credits, after which prospective teachers must take an examination to obtain a teaching certificate. The examination consists of items that relate to both subject-matter knowledge and knowledge of pedagogical techniques. The candidate is also required to present and discuss a proposal for a teaching unit, or to present something similar. The examination does not assess subject-matter knowledge directly; rather, it implies it. Subject-matter knowledge is assessed when students are admitted into the postgraduate course.

Despite the Bachelor's-level requirements in place for both primary and secondary teachers, many practicing pre-primary and primary teachers hold only secondary-level degrees because they were in the teaching system before the new requirement came into effect in 1998. Some secondary school teachers do not have university degrees. They generally are laboratory-technician teachers and teachers who were teaching subjects no longer taught at the lower-secondary level, but who decided to remain in the secondary school teaching force. According to our analysis of the Survey of Italian Households' Income and Wealth, nearly five million Italians had secondary-level teaching degrees in 2004 (but were not necessarily working as teachers), while 456,000 working teachers had a Bachelor's degree.

Teacher recruitment and hiring

Hiring of teachers in Italy previously involved a competitive examination through which permanent teachers were assigned to school posts. The examination consisted of a written test for all candidates and an interview based on the candidate's teaching subject. This evaluation focused almost exclusively on candidates' knowledge of their subject matter, not on their teaching ability. While the examinations were supposed to take place every four years, stagnating demand for teachers meant that the last two examinations took place nearly 10 years after the preceding examination.

Because the examination was administered infrequently and because its administration rarely corresponded to actual demand for classroom teachers, teachers frequently gained their teaching posts by taking short training courses (*corsi abilitanti*) that allowed them to transition from temporary teaching work to permanent posts. Thus, a significant proportion of teachers were considered temporary. In effect, there was a two-track teacher recruitment system, with the first consisting of the rigorous examination-based mechanism and the second allowing the temporary hiring of teachers who did not meet the official requirements but who often become permanent by decree. Moreover, temporary assignments, which were particularly common for teachers in lower-secondary schools, were the only route into teaching between official examination dates.

In the early 2000s, when the first teachers began graduating under the new university-degree requirements mandated by the 1998 law, the *corsi abilitanti* ended. Today, aspiring teachers must obtain certification (*abilitazione*) via a university degree or by passing the final examination in the post-degree course. Since 2003, all teacher candidates, on completing their pre-service courses (university degree, postgraduate specialization), have been placed on "lists" that establish them as seeking a permanent position. Since 2007, all teachers on the existing lists are guaranteed a permanent position (mainly by replacing the large number of retiring teachers). Monitoring of teacher placements (especially as they relate to different school subjects in different areas of the country) was established at the end of 2008. Reform of the training and hiring system is presently being discussed.

Teacher salaries and remuneration

Teacher salaries in Italy are based on seniority and level taught. During their careers, teachers receive seven separate salary increases, corresponding to their level of experience: 0 to 2 years, 3 to 8 years, 9 to14 years, 15 to 20 years, 21 to 27 years, 28 to 34 years, and 35-plus years.

Teachers have few other means of increasing their salaries. The main one is to become a school administrator, which requires a competitive examination. Teachers in secondary schools also earn significantly more than teachers in primary schools. After 15 years of experience, for example, upper-secondary teachers in 2003 earned 1.49 times the salary of primary teachers per teaching hour, compared to the OECD average ratio of 1.38. However, the difference between the upper- and the lower-secondary levels of the school system was minimal, with upper-secondary school teachers earning $US54 per teaching hour compared to $US53 per teaching hour for lower-secondary school teachers. Among lower-secondary school teachers, the ratio of the highest paid (those with 35 years of experience or more) to the lowest paid (starting teachers) of 1.5 was lower in Italy than the OECD average of 1.7, indicating a smaller than average premium for experience (OECD, 2005).

Teachers can also raise their salaries by taking on special tasks and responsibilities within the school (such as for assessment and evaluation, school–family relationships, and department co-ordination). The school principal assigns these responsibilities according to decisions made by the School Teacher Council.

Relative to other OECD member countries, teachers in Italy earn lower than average salaries at all levels. At the lower-secondary level, for example, beginning Italian teachers in 2003 earned $US25,602, compared to the OECD average of $26,241 (using purchasing power parity). Teachers in Italy with 15 years of experience and minimum training earned $31,304 compared to the OECD average of $35,876. Consequently, while OECD beginning salaries were only 2% higher than those of Italian teachers, OECD teachers with 15 years of experience earned almost 15% more than Italian teachers with the same degree of experience and training (OECD, 2005). However, because Italian teachers typically work a lower number of hours than the OECD average, they actually compare relatively well with OECD and European Union (EU) teachers in terms of hourly wages. In fact, beginning Italian teachers in 2000 earned more per hour ($37) than the OECD average of $32.60 and the EU average of $35.90.

Teachers' salaries as a percentage of GDP per capita—a measure of the value of teachers relative to economy-wide resources—decreased between 1993 and 2000, indicating an implicit devaluation of teaching services in Italy over this period. For example, a starting lower-secondary teacher in 1993 earned 1.07 times the GDP per capita, while a new teacher in 2001 earned 0.95 times the GDP per capita. At the same time, however, the real salaries of lower-secondary teachers increased by 11% between 1996 and 2003, indicating that, despite the decrease in relative salaries, absolute salaries actually increased over this period (OECD, 2005).

Although paid relatively low salaries, teachers in Italy compared to Italian workers in the private sector enjoy many non-pecuniary benefits, including employment security, lower working hours than the European average, low student–teacher ratios, relatively good retirement benefits, and generally high maternity- and sick-leave protections. Moreover, according to a 1994 poll of Italian public employees, teachers ranked highest in terms of the percentage (62.3%) of respondents with higher or average satisfaction regarding their working conditions.

In our analysis of the Survey of Italian Households' Income and Wealth data, we could only estimate the earnings of individuals who were *trained* as teachers, not those who *worked* as teachers. We compared these earnings to those of individuals trained in other fields. Many older Italian (mainly primary) teachers only have secondary-level (normal school) education, which is one reason why Italian teachers seem to earn lower relative incomes compared to teachers in other OECD countries. However, in terms of today's labor market, we need to focus on the comparative salaries of teachers with university education because that is the requirement young teachers must now meet. Thus, in the tables below (31 and 32), we show the salaries of individuals trained as teachers at the secondary and university level compared to the salaries of individuals trained in other fields. However, in the graphs (Figures 34 to 37), we compare only those individuals trained at the university level.

Table 31: Italy, Mean Annual Earnings, by Gender, Education Level, and Type of Education, 1995 (euros)

	Males					Females			
	Secondary Degree		*Bachelor's Degree*			*Secondary Degree*		*Bachelor's Degree*	
Age	Normal School	Technical School	Teacher	Scientist	Engineer	Normal School	Technical School	Teacher	Scientist
20–24		4,942				4,242	5,634		
25–29	6,852	8,083		2,716	4,659	5,921	6,834	6,518	4,360
30–34	3,802	8,490	8,759	8,925	15,326	7,424	7,490	7,800	8,893
35–44	6,705	10,398	10,778	12,968	15,277	9,290	6,977	10,826	10,504
45–54	13,295	11,717	15,497	13,855	16,203	9,857	7,582	12,857	11,965
55–64	10,056	6,484	13,405	4,579	6,649	4,481	2,954	13,435	2,201

Source: Bank of Italy, Survey of Italian Households' Income and Wealth, 1995.

Table 32: Italy, Mean Annual Net Earnings, by Gender, Education Level, and Type of Education, 2004 (euros)

	Males					Females				
	Secondary Degree		*Bachelor's Degree*			*Secondary Degree*		*Bachelor's Degree*		
Age	Normal School	Technical School	Teacher	Scientist	Engineer	Normal School	Technical School	Teacher	Scientist	Engineer
20–24	9,270					8,170	7,288		6,413	
25–29	11,039		14,798	12,583	15,592	10,158	12,122	14,718	8,803	11,578
30–34	12,068	14,644	20,000	41,182	18,756	9,585	12,531	12,370	15,039	16,507
35–44	12,703	13,213	18,236	29,257	24,128	11,165	12,601	14,751	18,841	8,919
45–54	16,491	16,977	23,581	19,390	20,439	12,846	13,531	16,844	15,968	48,416
55–64	8,754	12,602	22,825	21,871	11,848	6,954	7,208	17,338	2,705	

Source: Bank of Italy, Survey of Italian Households' Income and Wealth, 2004.

Figure 34: Italy, Annual Net Earnings of Males with Bachelor's Degree, by Age and Occupation, 1995

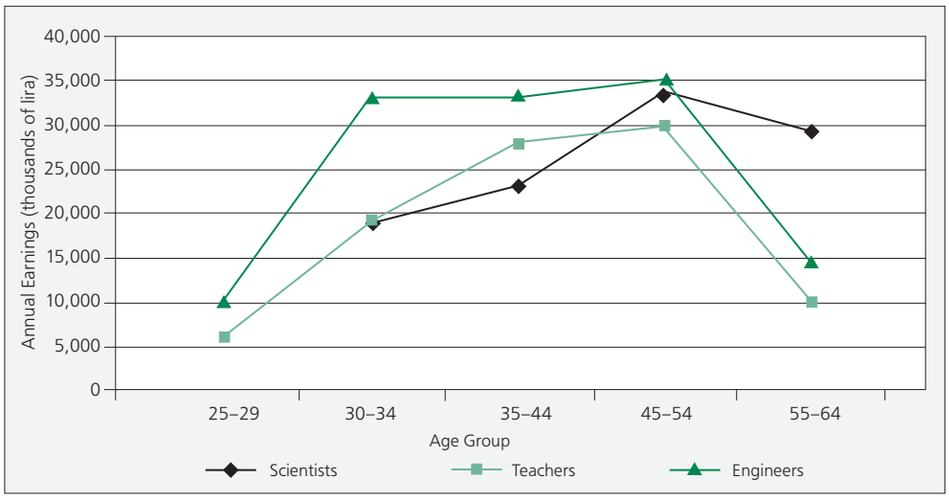


Figure 35: Italy, Annual Net Earnings of Females with Bachelor's Degree, by Age and Occupation, 1995

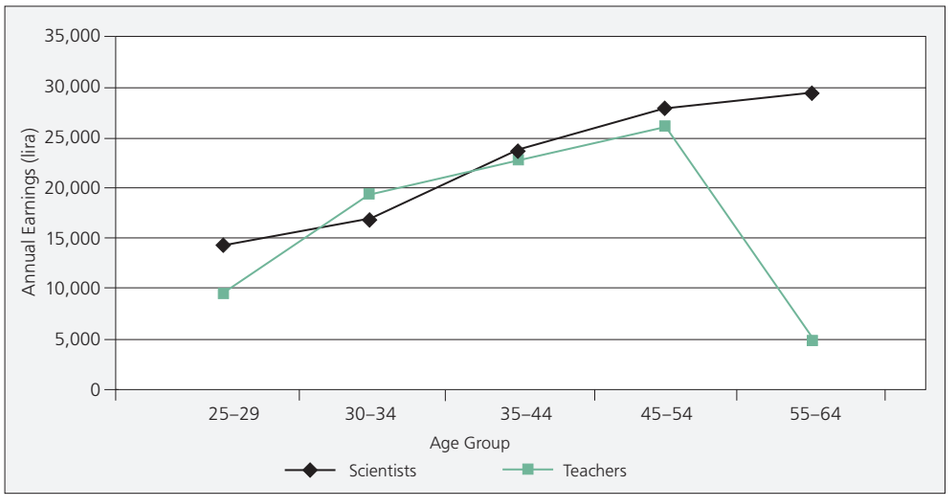


Figure 36: Italy, Annual Net Earnings of Males with Bachelor's Degree, by Age and Occupation, 2004

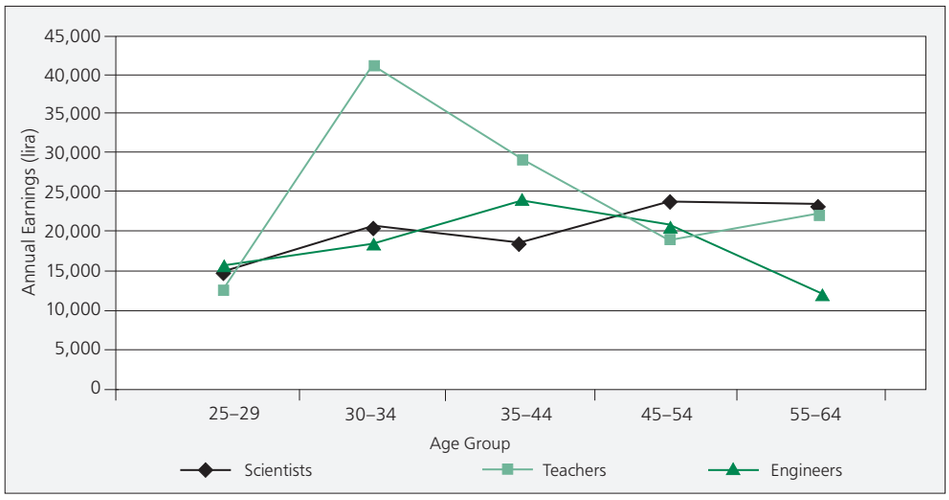
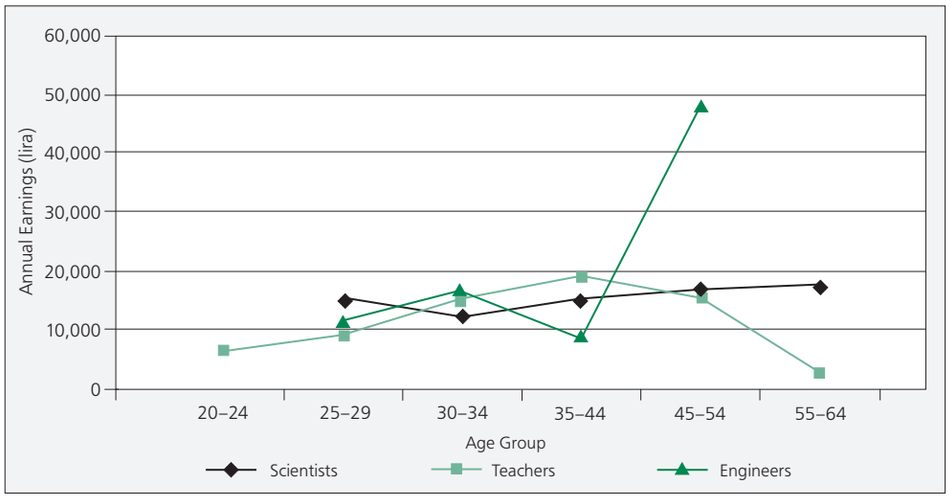


Figure 37: Italy, Annual Net Earnings of Females with Bachelor's Degree, by Age and Occupation, 2004



The tables and figures suggest that, compared to females with technical and scientific training, Italian females who studied to be teachers were doing rather well in the 1990s, whether they had studied teaching at secondary level or had a university degree. However, males who had studied teaching at the secondary level were earning less than males with technical secondary training, while males with a Bachelor's degree in education were earning much less than those trained as engineers. However, they were earning more or less at the same level as graduates with science-based degrees, particularly in 2004. Another feature of note from the tables and figures is that the mean net annual earnings for all these professions is not very high.

References

Bank of Italy. (1995). *Survey of Italian Households' Income and Wealth*. Rome: Author.

Bank of Italy. (2004). *Survey of Italian Households' Income and Wealth*. Rome: Author.

Drago, R., Basaglia, G., & Lodolo, V. (2003). *Attracting, developing, and retaining effective teachers: OECD country background report for Italy*. Rome: Ministry of Education, University, and Research.

Organisation for Economic Co-operation and Development (OECD). (2005). *Education at a glance: Education indicators 2005*. Paris: Author.

Korea, Republic of[13]

Composition of the teacher labor force

Elementary schools have suffered from a teacher shortage in recent years, mainly because a sudden reduction in the teacher retirement age in 1999 saw a large number of teachers choosing to take a favorable early retirement package. Secondary schools, however, have had the opposite problem of a very large oversupply of candidates vying for a limited number of spots. There is close to a 5:1 ratio of candidates to positions available, mostly because the government and teacher education institutions have failed to control the number of students entering these institutions. In numerical terms, about 5,000 elementary school candidates are supplied every year by the national universities of education, and about 25,000 secondary school candidates are supplied through other institutions of education. Therefore, while a number of excellent students compete for spots in elementary schools, highly qualified students shy away from secondary schools. This oversupply of the secondary school teaching workforce has led to a weakening of secondary school teacher education.

The total number of teachers in 2002 was 357,084. Of this number, nearly 21% were in high schools, just over 11% in vocational schools, nearly 27% in middle schools, and just over 41% in elementary schools. The ratio of female to male teachers has increased rapidly over the last two decades, with female teachers comprising roughly 68% of the teacher workforce in 2002. The proportion of female teachers in that year was 71% in elementary schools, 61% in middle schools, and 32% in high schools. Females cite the still high social status accorded to teachers and the favorable maternity leave policy as their main reasons for choosing the teaching profession.

Rapid industrialization, economic growth, and many new, financially rewarding employment options in the 1980s and 1990s lowered the aptitude of those choosing to enter the teaching profession. Talented individuals who had graduated from institutions of education moved into these newly opened sectors, and some teachers left schools for better-paying jobs. This factor, along with those mentioned above, contributed to the teacher shortages within the elementary schools. In the late 1990s, however, South Korea's economy went through a recession and individuals were once again attracted to the stable nature of the elementary school teaching profession. High school graduates with excellent achievement backgrounds began increasingly to enter elementary school teacher education institutions because elementary schools offered ready employment opportunities. Women, who still experience discrimination in other job sectors, especially find the prospect of teaching in elementary schools attractive; 78% of the entrants into elementary teacher education institutions are females with excellent academic records. If the government did not set a quota on the number of female applicants, the proportion would be over 90%.

In contrast, the oversupply of secondary school teachers means that the number of highly qualified applicants to secondary school teacher education institutions is declining quickly. In like manner, scores on the university entrance examination that applicants must pass in order to enter teacher education institutions have dropped in recent years. Secondary school teacher quality has further declined because of potential applicants being deterred by the more negative social image of teachers that has recently

13 Referred to as South Korea throughout this section.

developed, and by the relative drop in teachers' economic status. The government has consequently put forward measures to increase teacher salaries and welfare benefits, establish a better promotion and evaluation system, and improve working conditions by reducing class sizes.

Teacher education and certification

South Korea's elementary school teachers are trained in national universities of education and departments of elementary education at colleges of education. They can also take elementary education courses in graduate schools. Most elementary school teachers receive their pre-service education at the 11 teachers colleges that make up the National University of Education. Pre-service education for secondary school teachers occurs mainly through four different channels: departments of education, colleges of education, graduate schools of education, and teacher education courses in comprehensive universities. Potential candidates for both levels of education can also qualify by taking re-education or compensational education courses.

To obtain an actual teaching certificate, candidates must earn credits in both teacher education and major subject courses in one of the aforementioned education programs, and subsequently obtain formal authorization. For example, secondary school teachers must take around 140 credit hours over four years, and they must complete at least 42 credits from a major subject and 20 credits in teacher education courses. Students taking education courses in comprehensive universities must additionally score 80 points or higher in both subject areas. Students who fulfill these requirements earn automatic authorization and a Grade 2 teacher certificate. If employed as a teacher, they can subsequently work for another three years and participate in in-service education so as to acquire a Grade 1 teacher certificate—a qualification that provides a significant step up the salary scale.

Elementary school teachers who want to teach mathematics must take at least 21 credit hours of subject-based and pedagogical courses related to mathematics in order to earn a certificate. Their subject courses can include classes on calculus, probability and statistics, algebra, geometry, and linear algebra. Their pedagogical courses tend to cover areas such as teaching methods and the theory, assessment, and psychology of mathematics education. The secondary school teacher mathematics curriculum emphasizes subject matter to a much greater extent than does the elementary school teacher mathematics curriculum. Seoul National University, for example, requires students to take 18 mathematics knowledge courses and five pedagogy knowledge subjects. The course requirements for secondary school mathematics teachers are thus essentially the same as for majors in regular departments of mathematics.

After acquiring the teaching certificate, teachers must also pass a national employment examination in order to be assigned a teaching job. The first part of the examination is a written test, 30 points of which derive from education-related questions and 70 points of which derive from major subject questions. This first part whittles down the number of applicants to equal 120% of the employment spots. The remaining candidates are then screened via the second examination component, which comprises essay writing and a short interview.

The test for mathematics teachers is particularly comprehensive and covers 10 major areas of college mathematics and mathematics education, as well as general education theory. Because only about 16% of secondary school mathematics teacher candidates

successfully pass the examination, generally only those individuals with an excellent grasp of mathematics acquire positions as secondary school teachers. However, the examination emphasizes rote memorization rather than the more practical learning that prospective mathematics teachers can potentially acquire through university courses.

Finally, all new teachers must take up in-service education. This consists of practical, pre-employment training over two weeks as well as post-employment field training for six months. The aim of this provision is to give new teachers instructional guidance, evaluation, and classroom supervision. However, it tends to be criticized for being overly formalistic and directed toward occupational promotion rather than teacher professionalism.

Teacher recruitment and assignment

This is primarily determined by the superintendents of the 16 metropolitan and provincial offices of education. They set the quota of teachers for each curricular subject and foster open competition for teaching positions via the national teacher employment examination. Although elementary school and secondary school candidates sit different examinations, the process of selection is the same for both levels. Private school principals can employ teachers through separate selection methods such as interviews. However, in order to encourage transparency, they are recommended to follow the open-competition examination method as well.

Korea's seventh curriculum policy of late 1997 encouraged the hiring of more teachers able to teach diverse subjects such as English or computers in secondary schools. The government has also been trying to attract professionals with special knowledge and skills to enter teaching on a limited basis—a move that teacher unions strongly oppose. Also, despite an increased demand for specialized education, especially in vocational high schools and special-purpose high schools, and a commensurate demand for specialist teachers, Korean school principals in upper-secondary schools do not seem to find it difficult to hire the fully qualified specialist teachers (including of mathematics and science) that they need (Kim & Han, 2002).

Teacher salaries and remuneration

A rough annual approximation of the national salary schedule for secondary school teachers in 2001 was $US25,045 for a starting teacher, $US42,713 for a teacher with 15 years of experience, and $US68,449 for a teacher with about 37 years of experience and thus at the top of the salary scale (OECD, 2001). In 2001, elementary teachers were paid nearly the same or slightly higher. The percentage increases in salaries for all teachers become higher as they get older, and the salary schedule is set so that it applies equally to males and females.

The basic salary structure for both elementary school teachers and secondary school teachers is determined by seniority and assorted allowances. A unitary salary-step scale, where teachers with the same academic credentials and seniority belong to the same salary step, is used across all levels of schooling. Assorted allowances are uncommon and are given to teachers who shoulder additional positions or responsibilities such as departmental chair. Teachers do not earn additional pay for mathematics/science knowledge. However, teachers who assume additional management responsibilities, teach special education, teach more classes or hours than contracted, teach in remote or disadvantaged areas, or experience changes in their marital and family status can gain salary increases (Kim & Han, 2002).

Since 2001, the government has distributed merit bonuses of up to 50% to 150% of one month's salary, with the intention of fostering competition and increasing teacher quality. In 2001, however, 90% of the total amount was given to all teachers without distinction because of difficulties in evaluating their performance. Teacher salaries are therefore based mainly on years of experience rather than on ability.

Teachers also receive many benefits beyond the basic salary structure. For example, teachers receive tuition support for their children to attend secondary school,[14] as well as non-interest loans for their children to attend university and obtain living expenses. Other notable benefits include a pension fund that ensures a stable financial condition after 20 years of work, overseas study opportunities, and a possible one year of maternity leave for women that does not disadvantage them in terms of career salary or promotion calculations. The amount of teaching time in hours per year is also relatively low for secondary school teachers in Korea, compared to other OECD countries, and teachers in general have up to 100 days per year of vacation. Finally, teachers are guaranteed tenure without contract renewal. Their main reasons for leaving the teaching profession are thus either retirement at age 62 or personal choice.

Disadvantages associated with the teaching profession in Korea include the fact that teachers are stuck in a rigid career structure with long periods between promotions and intense competition for highly coveted administrative positions. Also, teachers complain of a relatively heavy administrative workload and their class sizes tend to be larger than those of most OECD countries. Furthermore, despite the traditional emphasis on education and respect for teachers, the media and public have recently sported a relatively negative image of the teaching profession, which has apparently demoralized teachers in general.

On the whole, despite the fact that a teacher with 15 years of experience had a salary 2.69 times the GDP per capita in 2001, teacher salaries were still considered relatively weak when compared to those of other professionals of a similar academic background (OECD, 2001). Assuming that educational attainment is controlled for, the figures suggest that teacher salaries in 2001 were relatively low compared to the salaries of individuals in private-sector corporations. To give a general idea, a computer operator in 1999 made 10% to 30% more than an average secondary school teacher, a civil engineer made 30% more, while a social worker made 30% less (OECD, 2001). In response to these differentials, the government issued its "Five Year Plan to Upgrade the Salary of Public Servants," and stated its intentions to raise teacher salaries to the level of employees in private firms by 2004. In terms of formal workload, teachers supposedly enjoy more free hours relative to other professionals. Teachers typically work eight hours each weekday and four hours on Saturday.

14 In Korea, just over 1% of elementary schools, 24% of middle schools, and 46% of high schools are private. The government provides subsidies to private secondary schools to support teacher salaries. The government also has tight standards for tuition fees, the curriculum, teacher recruitment, and the like in private schools. Whether public or private, middle schools are free (no tuition costs). However, parents must pay fees in both public and private high schools. The government randomly assigns all entering secondary school students to public and private schools (rather than on the basis of an entrance examination or some other mechanism). Evidence suggests that parental spending on private tutoring expenses—generally to prepare students for college entrance examinations—has been increasing steadily, burdening family budgets. This matter also raises an interesting point about the extent to which students are actually gaining their mathematics knowledge in middle and secondary schools.

Salaries of teachers relative to mathematics-intensive and other occupations

The best dataset for estimating earnings by education, age, and occupation is the Korean Employment Survey, conducted every two years. However, the survey covers only private-sector firms with 10 or more employees, and thus poses a disadvantage because it provides no data on employees of public schools and on scientists and engineers working for public institutions. Nevertheless, given that a significant proportion of secondary school middle teachers work in private schools, the estimates from the employment survey do give us at least some information about an important part of the teacher labor force in Korea.

A comparison of the earnings in Tables 33 and 34 with those from the OECD 2001 indicators suggests that private school teachers earn about the same as public school teachers. The estimated median salary of 25- to 29-year-old private school male teachers was approximately $US1,800 per month. Where the OECD figures represent a 12-month salary, we can assume that a public school teacher of that age was earning more than $US2,000 per month in 2001. However, if the annual salary reported to the OECD for 2001 was for 13 or 14 months (teachers in many countries automatically receive extra months of "bonus" salary), then the salary we estimate could be similar to a public school salary.

Another source of comparison is the base salary schedule for teachers with a university degree. In 2005/2006, the base salary for 25- to 29-year-old teachers was about $US1,400. However, if we take account of "add-ons," the total remuneration is close to that earned by private school teachers. Older teachers in private schools appear to earn somewhat less than their counterparts in public schools, even when add-ons are considered. More experienced teachers may thus shift from private to public schools, where salaries appear to be higher.

Table 33: Korea, Median Monthly Earnings of Private-Sector Professional Employees Who Have Completed College or Higher, by Gender, Age, and Occupation, 1996 (US dollars)

Males				
Age	*Scientists & Engineers*	*Secondary School Teachers*	*Primary School Teachers*	*Non-Scientists and Engineers*
20–24	1,063	1,041		1,067
25–29	1,526	1,646	1,556	1,487
30–34	2,202	2,049	2,080	2,030
35–44	2,847	2,465	2,492	2,685
45–54	3,332	3,253	3,004	3,440
55–64	3,627	3,798	3,536	3,668
Females				
Age	*Scientists & Engineers*	*Secondary School Teachers*	*Primary School Teachers*	*Non-Scientists and Engineers*
20–24	1,052	1,248	1,094	1,067
25–29	1,434	1,661	1,218	1,456
30–34	2,122	1,993	1,579	1,951
35–44	2,480	2,424	2,044	2,444
45–54	3,090	3,274	2,778	3,249
55–64		3,454	767	2,482

Source: Estimates of earnings provided by the Korean Labor Institute, using data from the National Statistics Office, Korean Occupational Wage Survey, 1996.

Table 34: Korea, Median Monthly Earnings of Private-Sector Professional Employees, by Educational Level, Gender, Age, and Occupation, 2004 (US dollars)

Private-Sector Workers with Bachelor's Degree						
	Males			*Females*		
Age	Scientists & Engineers	Secondary School Teachers	Non-Scientists & Non-Engineers	Scientists & Engineers	Secondary School Teachers	Non-Scientists & Non-Engineers
20–24	1,066	1,674	915	1,251	1,264	1,058
25–29	1,507	1,797	1,460	1,792	1,564	1,395
30–34	2,230	2,007	2,044	2,368	1,995	1,847
35–44	3,020	2,622	2,758	2,704	2,750	2,250
45–54	3,449	3,233	3,249	3,793	3,195	2,051
55–64	2,462	3,712	2,746		2,748	1,772
Private-Sector Workers with Master's Degree						
	Males			*Females*		
Age	Scientists & Engineers	Secondary School Teachers	Non-Scientists & Non-Engineers	Scientists & Engineers	Secondary School Teachers	Non-Scientists & Non-Engineers
20–24	1,594		1,064	1,068		957
25–29	1,860	1,841	1,786	1,948	2,135	1,608
30–34	2,603	1,881	2,338	2,804	2,016	2,057
35–44	3,623	2,612	3,251	3,116	2,891	2,576
45–54	4,612	3,364	3,989	4,276	3,121	3,498
55–64	4,010	3,923	4,480	2,800	2,124	4,503

Source: Estimates of earnings provided by the Korean Labor Institute, using data from the National Statistics Office, Korean Occupational Wage Survey, 2004.

We consider, however, that our estimates of teacher earnings may be on the low side, especially in regard to older teachers and to females, who (assuming they work in the public sector) receive the same salary rates as males. Also, because teachers obtain a monthly salary for 12 months (sometimes more in bonus-like situations), along with 100 days of vacation (remember that private school teachers' salaries are subsidized by the government), teachers' hourly earnings compare much more favorably with hourly earnings in other occupations. (Individuals in competing occupations are entitled to far fewer vacation days.)

Comparison of individuals in teaching and in competing occupations with Bachelor's degrees indicates that the earnings of mathematics teachers in Korea are the same or higher than the earnings of scientists and engineers of the same age and higher than the earnings of non-scientists and engineers. Primary school teachers earned somewhat less in 1996—particularly in the case of females—but our data for 2004 suggest that at this time they were earning about the same amount as secondary school teachers. We found it difficult to compare the 1996 data with the 2004 data because we could not estimate the 1996 data by level of higher education (Bachelor's versus Master's). However, it appears that the salary patterns had changed little across the eight years.

The situation is not the same for individuals with a Master's degree. Apparently, the payoff for private school teachers who gain a Master's degree, while positive, is much smaller than in other occupations. Better data on public school teachers' salaries would allow us to determine more accurately if teachers with Master's degrees are at a relative pay disadvantage, at least in terms of annual salary (they might still be at an advantage in terms of hourly salary).

If the data in Tables 34 and 35 (and also in Figures 38 to 41) are a reasonably accurate estimate of teachers' relative economic position, then it is understandable why such a large number of students choose to major in education and why there is such a large surplus of candidates for secondary school teaching positions. If a young person can earn the same salary in nine months of work as someone else working 11 months, then his or her choice of profession seems reasonably straightforward. The similarity of absolute monthly earnings for holders of Bachelor's degrees also partly reflects earning equalities in Korea. Males tend to earn more than females, particularly among non-scientists and non-engineers (the non-mathematics-intensive professions), and especially (in that occupational category) if they are older in age and/or have a Master's degree.

Figure 38: Korea, Median Monthly Earnings of Male Private-Sector Employees with Bachelor's Degree, by Age and Occupation, 2004

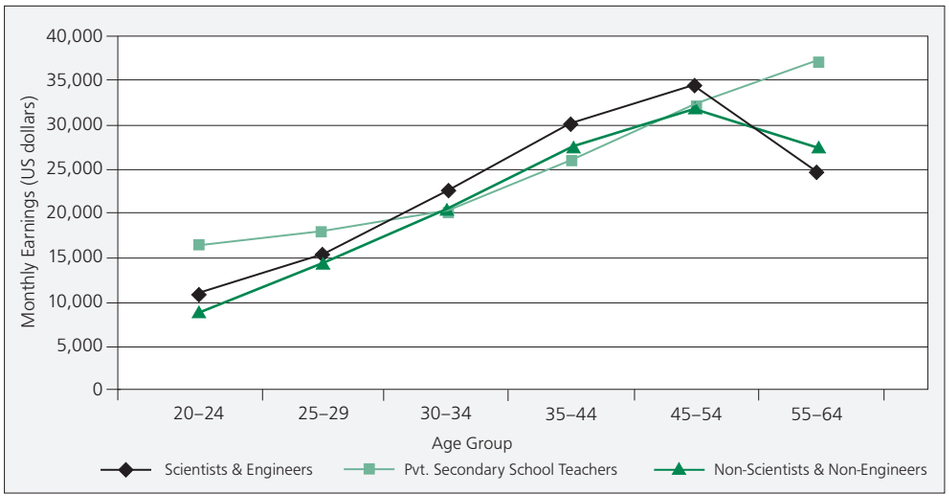


Figure 39: Korea, Median Monthly Earnings of Female Private-Sector Employees with Bachelor's Degree, by Age and Occupation, 2004

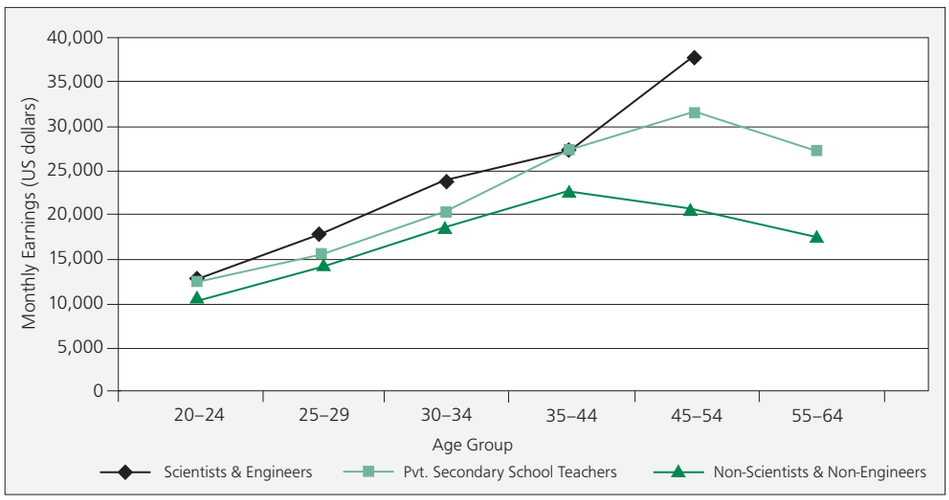


Figure 40: Korea, Median Monthly Earnings of Male Private-Sector Employees with Master's Degree, by Age and Occupation, 2004

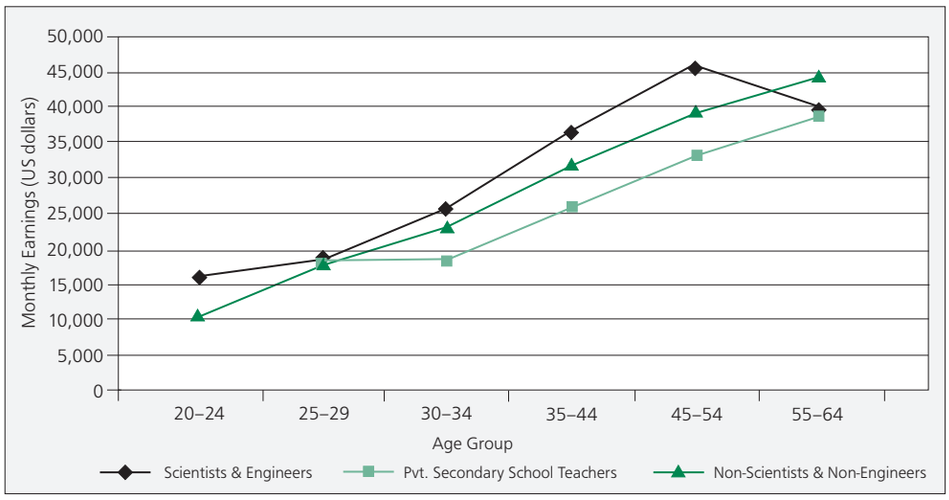
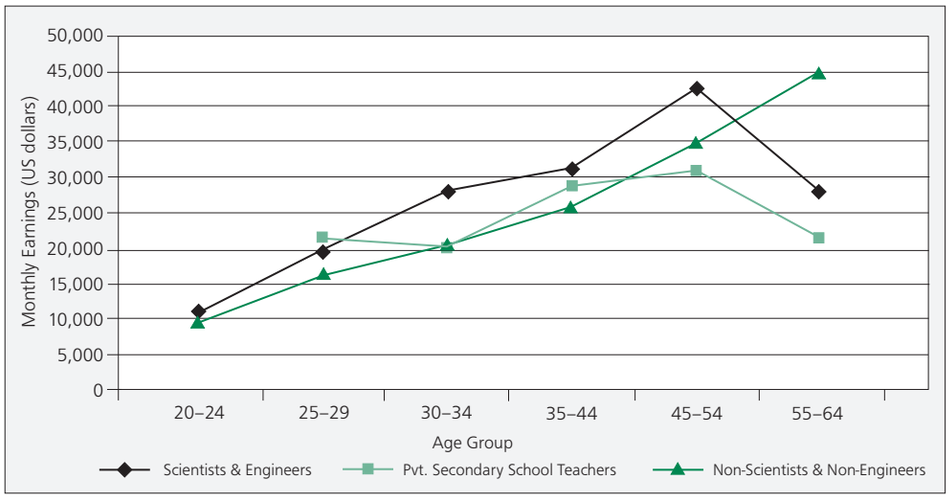


Figure 41: Korea, Median Monthly Earnings of Female Private-Sector Employees with Master's Degree, by Age and Occupation, 2004



References

Kim, E., & Han, Y. (2002). *Attracting, developing, and retaining effective teachers: OECD background report for Korea.* Seoul: Korean Educational Development Institute.

Organisation for Economic Co-operation and Development (OECD). (2001). *Education at a glance: Educational indicators 2001.* Paris: Author.

Mexico

Composition of the teacher labor force

In 2003, there were just over one million basic-education teachers in Mexico, distributed among preschool teachers (15.6%), primary teachers (53.3%), and lower-secondary teachers (31.1%). Of the 233,844 upper-secondary teachers, 13.5% were teaching in vocational/technical schools and the rest were teaching in regular high schools (Guevara & González, 2004). Mexican primary teachers spend, on average, longer in teaching than preschool and secondary teachers spend. Their average age is 43 and their average number of years of teaching is just under 19. Preschool teachers average 38 years of age and nearly 14.5 years of teaching, while secondary teachers are, on average, just over 44 years of age and have 17.8 years of experience.

Despite their high levels of experience, only around 41% of primary teachers in 2003 had met or exceeded the national educational requirements required to teach in primary schools. In contrast, nearly 48% of preschool teachers and 88% of secondary teachers had met or exceeded the educational requirements for the level in which they taught (Institute for Educational Assessment and Evaluation, 2004).

Mexico's teacher labor force is less feminized than the teaching labor force of most of the countries in this sample. Only 65% of primary teachers in Mexico are female. Of them, 48% are basic secondary teachers and 41% are *preparatoria* (upper-secondary) teachers.

Most teachers in Mexico work in public schools, although the percentage in public schools decreases as the level of education increases. In 2003, 92% of primary students were attending public schools and an equal percentage of primary teachers were teaching in public schools. At the lower-secondary level, the percentage of students in public schools was also 92%, but the percentage of teachers working in public schools was smaller (86%). This discrepancy is probably the result of much lower class sizes in private secondary schools. According to the OECD (2004), there are approximately 13 more students per teacher in public schools than in private schools at the secondary level in Mexico. Also, the percentage of students attending private schools is much larger in Mexico City (approximately 20% for basic education) than in the rest of the country (Guevara & González, 2004).

Demographic changes in Mexico suggest decreasing demand for teachers at all levels of basic education in the near future, but particularly for primary teachers. The population of children of primary school age is expected to fall 18% from nearly 14 million in 2001 to just over 11 million in 2015, but the number of new primary teachers entering the profession is growing (Guevara & González, 2004). The number of children in lower-secondary school (ages 12 to 14) is expected to decrease as of 2006, resulting in a 12% decrease in the demand for teachers at this level between 2000 and 2015. Among upper-secondary teachers, a shrinking student population (ages 15 to 17) is expected to result, from 2009 on, in a five percent decrease in demand for teachers at this level.

Teacher education

Primary school teachers in Mexico traditionally trained in normal schools, but since the mid 1980s, all primary and secondary teachers have been required to obtain university-level degrees, from either university or post-secondary normal schools. Although secondary school teachers generally have university degrees, a 2004 Mexican employment survey (National Institute of Statistics, Geography, and Information, 2004) found that a significant proportion of secondary teachers had not completed a university qualification.

In 2004, Mexico had 457 teachers' colleges nationwide, with an enrollment of 169,671 students. Public institutions enrolled 60% of the students attending teachers' colleges in 2004; the remaining 40% of students attended private teachers' colleges. In 2004, 28% of students attending teachers' colleges were enrolled in programs offering a primary teaching degree, compared with 39% in secondary teaching programs and 19% in preschool programs (Guevara & González, 2004).

In 1993, Mexico's Ministry of Education established the *Carerra Magisterial* (CM), a new promotion (and pay) system for teachers. The system allows teachers who voluntarily enter the CM to raise their salaries by a point system based on examinations, in-service training, and the performance of their students. By attaining CM points, teachers can double their salary while maintaining the same level of experience and pre-service education. This voluntary horizontal promotion arrangement is supposed to reward teachers who attempt to improve their skills as teachers and thereby improve student performance. Evidence suggests that teachers' scores on the academic knowledge section of the CM teacher test correlate significantly and positively with student performance, especially at the secondary school level (Luschei, 2005; Santibañez, 2002). Nevertheless, the CM is primarily a mechanism for substantially raising teacher pay by legitimizing that increase as part of a teacher-improvement incentive program.

Another development in the early 1990s (1992/1993) saw the central government devolving control of the federal portion of educational spending and school administration to the states. Today, the federal government provides block grants for education to the states, and the states then allocate resources as they see fit to the schools. Hiring of teachers also became the province of the states, although the teacher union continues to be organized at national level, and general salary policies continue to be negotiated nationally. The federal government (via the Ministry of Education) is still responsible for national plans, developing curricula and textbooks, developing materials for teacher education, and evaluating the national system (including individual state systems).[15] The federal government also supplies textbooks free to primary students.

15 The federal government established an autonomous evaluation institution, the Institute for the Evaluation of Education, in 2001. However, some states have set up (or are setting up) local centers that have taken on the task of developing programs designed to evaluate school performance.

Teacher salaries

Mexican teachers saw their real incomes and wages decline sharply in the 1980s relative to average incomes in Mexico, but these began to recover at the end of the 1980s and into the early 1990s. Lopez-Acevedo and Salinas of the World Bank compared the salaries of teachers with the salaries of other professionals who had completed upper- secondary and/or higher education in 1988, 1994, and 1999. They found that teachers' monthly income and hourly pay rose relative to professionals' monthly income and hourly pay in the early 1990s, but fell in the late 1990s (Lopez-Acevedo & Salinas, 2001). As we document below, we found a similar downward trend in the period 1996 to 2000, but another increase, particularly for female teachers, during the period 2000 to 2004. The rise in the early 1990s can be explained partly by the implementation of the *Carerra Magisterial* in 1993.

Our analysis of secondary teachers' annual and hourly salaries in Mexico involved comparison with the salaries of scientists, engineers, and social scientists for three years—1996, 2000, and 2004. Although, surprisingly, the average levels of education for scientists and engineers were lower than those for the secondary school teachers, who were mostly college graduates or had some graduate education, we restricted ourselves to comparing teachers with people from other occupation groups who were college graduates. Because of poor data, our restriction also extended in the year 2000 to individuals with postgraduate levels of education. The social scientists in the employment survey sample were also almost all college graduates or had some graduate training.

Table 35 presents the results of our estimates of annual salaries for the four occupational groups by gender across the three years; note that we controlled for level of education. The teacher category in the table comprises secondary teachers only. The results suggest that secondary teachers lost some ground, salary-wise, to other professionals in the 1996 to 2004 period, and that this loss held for both male and female teachers. By 2004, male teachers were earning one-half the monthly income of social scientists, the most comparable group education-wise; female teachers were earning about 80% of female social scientists' average income.

The results in Figures 42 to 45 for the hourly wages of secondary school teachers suggest a similar pattern regarding annual earnings. However, because teachers work fewer hours than those in other professions, teacher hourly salaries tend to be generally higher than the salaries in other professions. In 2004, female secondary school teachers earned relatively more compared to females in other mathematics-oriented professions, while male teachers, more experienced ones particularly, earned wages lower than those of males in other mathematics-oriented professions.

Table 35: Mexico, Estimated Annual Base Earnings for University-Educated Professionals, by Gender, Age, and Occupation, 2000, 2004 (2002 pesos)

Males, 1996					Females, 1996			
Age	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*
25–29	79,339	94,835	63,305	85,192	53,323	73,776	44,170	65,007
30–34	131,914	95,763	90,419	85,555	57,302		74,257	71,969
35–44	159,172	132,853	78,451	123,093	67,748		81,741	95,981
45–54		105,372	71,327	68,444	66,852			
55–64		202,945	109,830	429,765				
Males, 2000					**Females, 2000**			
Age	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*
25–29	80,259	88,940	57,920	76,781		65,009	52,770	60,576
30–34	80,259	127,601	62,233	147,141	38,792	120,388	43,808	90,769
35–44	66,882	167,771	64,008	126,137	40,972	57,519	58,836	95,642
45–54	89,435	131,415	84,683	118,159	64,207		71,932	66,882
55–64		137,109	66,962	127,076				
Males, 2004					**Females, 2004**			
Age	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*
25–29	72,816	96,238	41,687	93,614	45,396	85,279	52,866	72,908
30–34	102,108	13,2869	85,867	113,694	76,002	120,085	73,055	82,166
35–44	157,199	149,348	96,018	141,946	93,197	108,158	88,876	92,862
45–54	113,775	194,723	99,566	187,060	129,249		72,826	117,276
55–64		164,941	72,058	122,877			90,451	53,463
Male Earnings Ratio, 2004/1996					**Female Earnings Ratio, 2004/1996**			
Age	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*	*Scientists*	*Engineers*	*Secondary Teachers*	*Social Scientists*
25–29			1.15		0.85	1.16	1.20	1.12
30–34	0.92	1.01	0.66	1.10	1.33		0.98	1.14
35–44	0.77	1.39	0.95	1.33	1.38		1.09	0.97
45–54	0.99	1.12	1.22	1.15	1.93			
55–64		1.85	1.40	2.73				

Source: National Institute of Statistics, Geography, and Information, National Survey of Income and Household Expenditures, 2004.

Figure 42: Mexico, Mean Hourly Earnings of Males, by Age and Occupation, 1996

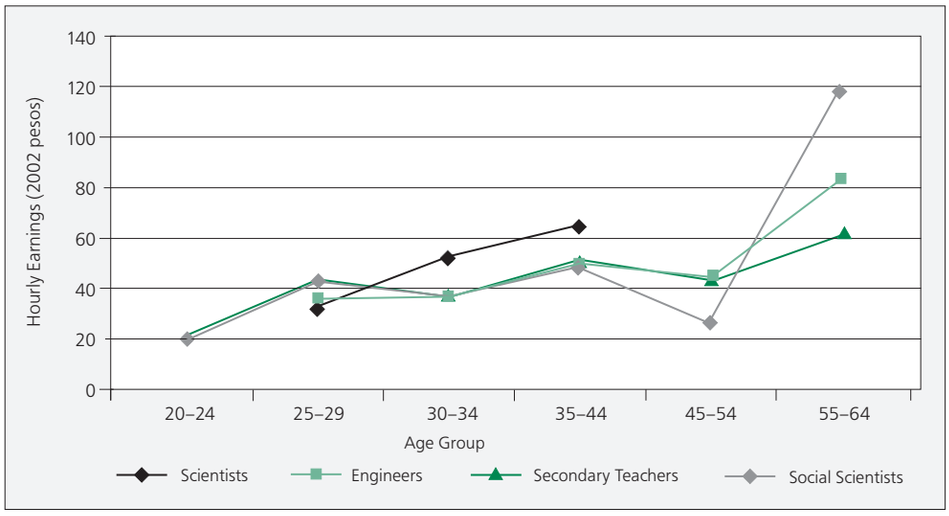
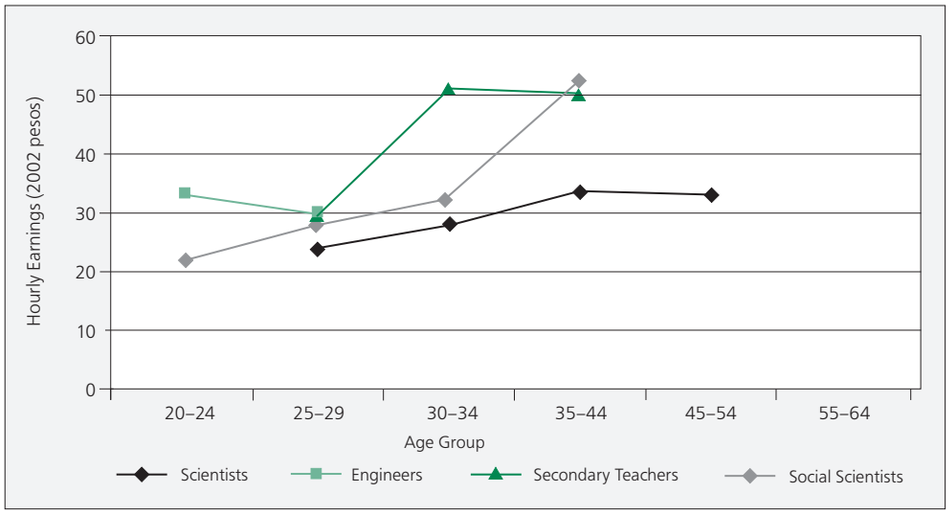


Figure 43: Mexico, Mean Hourly Earnings of Females, by Age and Occupation, 1996



In her study of urban teacher salaries in Mexico in the late 1990s, Santibanez (2000) compared teacher salaries with the salaries of other professionals, controlling for education, experience, and hours worked. She estimated that male secondary teachers earned a 13% hourly wage premium in 1998, and that female teachers earned a 30% premium. She also compared teacher wages in various Mexican states with the wages of other professionals in the same states. She found that, in general, teachers in northern states were in a less advantageous position relative to other professionals than teachers in the center of the country (except Mexico City) and the southern and eastern part of the country. This pattern makes sense, because teachers are paid about the same in various parts of the country, but economic opportunities for other professionals are greater in the more developed north of the country and in Mexico City.

Figure 44: Mexico, Mean Hourly Earnings of Males, by Age and Occupation, 2004

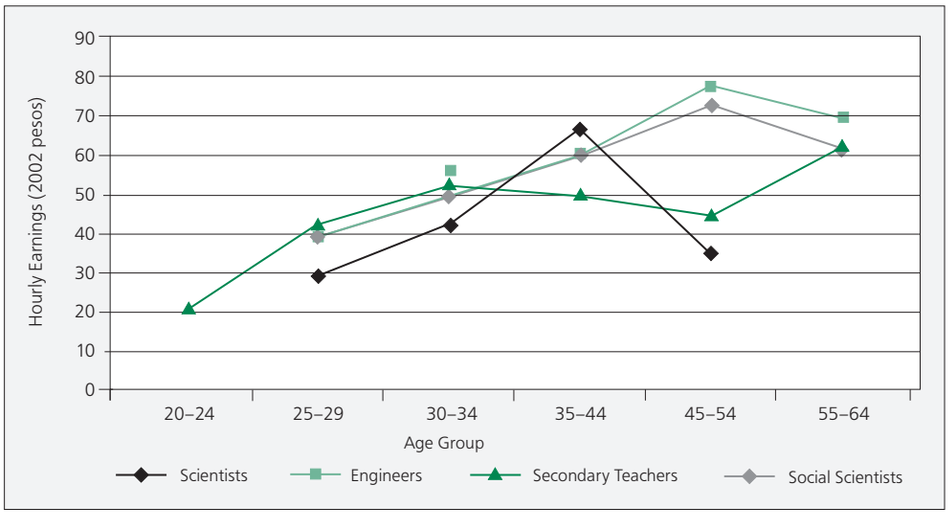
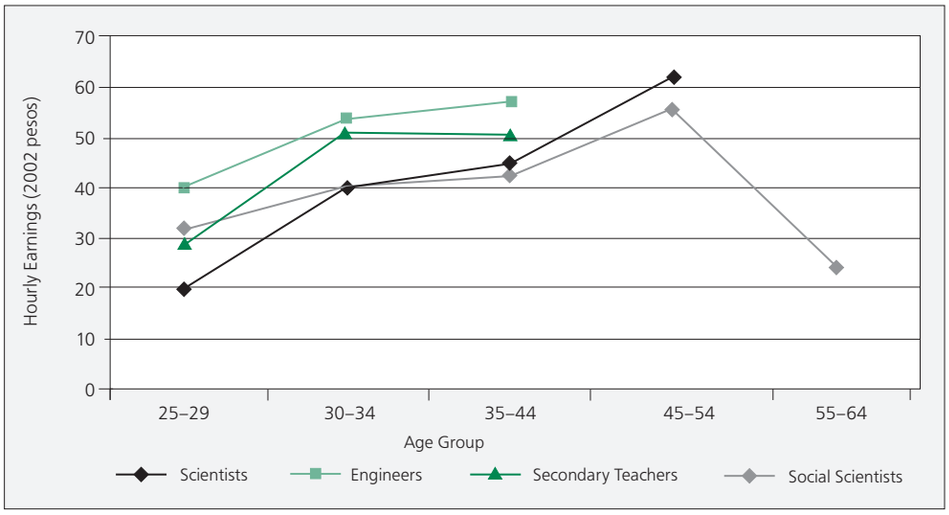


Figure 45: Mexico, Mean Hourly Earnings of Females, by Age and Occupation, 2004



References

Guevara, M. del R., & González, L. E. (2004). *Attracting, developing, and retaining effective teachers: Country background report for Mexico.* Paris: Organisation for Economic Co-operation and Development (OECD).

Institute for the Evaluation of Education. (2004). *Panorama educativo de México: Indicadores del sistema educativo nacional 2004 (Panoramic view of education in Mexico: National education system indicator).* Mexico City: Author.

Lopez-Acevedo, G., & Salinas, A. (2001). *Teacher salaries and professional profile in Mexico* (LCSHD paper series, No. 63 (February)).Washington, DC: Human Development Department, World Bank.

Luschei, T. (2005). *In search of good teachers: Patterns of teacher quality in two Mexican states.* Unpublished doctoral dissertation, School of Education, Stanford University, Stanford, CA.

National Institute of Statistics, Geography, and Information. (2004). *National Survey of Income and Household Expenditures.* Mexico City: Author.

Organisation for Economic Co-operation and Development (OECD). (2004). *Education at a glance: Education indicators 2004.* Paris: Author.

Santibanez, L. (2000). *Teachers in Mexico: Are they poorly paid? Estimate of relative teachers' salaries.* Stanford, CA: School of Education, Stanford University.

Santibanez, L. (2002). *Why we should care if teachers get As: Impact on student achievement in Mexico.* Unpublished doctoral dissertation, School of Education, Stanford University, Stanford, CA.

Norway

Composition of the teacher labor force

Nearly 73% of the teaching force at the primary and the lower-secondary levels of the education system are female. This proportion changes at the upper-secondary level, where the percentage of male teachers—at least of full-time teachers—is higher than that of female.

There is a general shortage of qualified teachers in mathematics, English, and Norwegian at the compulsory school level. While there is also some shortage in the natural sciences, the impact of this is felt mainly at the upper-secondary level. Regional shortages of teachers also exist, especially in the three northern-most counties of the country. The age structure of the teaching profession is skewed toward people nearing retirement, so there is concern that the supply of teachers will not be able to keep pace with demand (Lyng & Blichfeldt, 2003). The problem of aging teachers is more acute in upper-secondary schools, where approximately 50% of the teaching force is 50 years of age and over. The corresponding figure at the compulsory school level is 36.5%.

Not all qualified teachers choose to teach, and this is a problem, especially at the upper-secondary level. Only 67% of those teachers with extensive post-secondary-school study (at least five to six years at university) enter the teaching profession. Teachers with this level of qualification are particularly attractive to other professions, which makes their decision to choose or not choose teaching sensitive to changes in the labor market (Lyng & Blichfeldt, 2003). Sensitivity to labor market conditions is not seen at the compulsory schooling level, where there has been a steady increase in the proportion of graduates from teachers' colleges (four years of post-secondary education) who actually choose to teach.

Nearly 90% of eligible teachers opted for early retirement in 2001/2002. This figure contrasts sharply with retirement figures for other public-sector professionals. A large percentage of early teacher retirees (36.5%) are those who take up the option in their employment contracts that allows for early retirement at age 62. Research in this area is limited, but existing studies suggest that a significant percentage of teachers who leave the profession do so because of better labor market opportunities (Lyng & Blichfeldt, 2003).

There was a net outflow of teachers 45 years of age and over in 2006, and a considerable increase in early retirement between 2001 and 2006. The average early retirement age in schools is 63 years, and those who leave at this time do so with a full pension. However, teachers are staying longer in their jobs than previously. The mean age of retirement among all employed in schools increased from 57 years in 2001 to 60 in 2006, and health-related early retirement dropped between 2001 and 2006.

In 2006, approximately 11,000, or about 20%, of employed teachers were working in sectors other than schools (or kindergartens). Among new teacher graduates in 1999, 92% had found employment within six months of graduating (Arnesen, 2002). Of this group, only 7.6% were working outside the school sector. As we noted above, the extent to which teachers move out of the teaching profession and into other occupations is affected by labor-market conditions. A recent and unpublished study by three Norwegian economists shows that a reduction in unemployment in local labor markets tends to reduce the availability of qualified teachers (Ministry of Education and Research, 2009).

A report by Nordlandsforskning shows that the teachers most likely to leave the teaching profession are preschool teachers and heads of department and supervisors in kindergartens. There is little difference in leaving rate between basic school teachers and other employees in municipalities. One explanation for job stability among teachers is their high average age: job shifts are more frequent among younger than among older employees (Ministry of Education and Research, 2009).

Teacher education

School teachers in Norway are certified to teach only if they have completed education at the tertiary level. They can obtain this certification through colleges of teacher education or through a university/teacher education institution. The former involves completion of a four-year general teacher education (GTE) program at a teachers' college, and permits graduates to teach at the primary and lower-secondary levels.[16] The latter is a one-year postgraduate course culminating in a postgraduate certificate of education. It is offered by universities or teacher education institutions to individuals who have already completed a Bachelor's or a Master's degree, and its content centers on pedagogical and didactic education (OECD, 2004). Teachers certified in this manner can teach at the upper-secondary level, although a considerable number of them also work at the lower-secondary level (Hansen & Simonsen, 2001). The majority of Norway's teachers, however, receive their pre-service education through the GTE program. According to data from the Norwegian Employer/Employee Register, which covers Norway's entire working-age population, 90% of all teachers working in the country's compulsory and upper-secondary schools in 2005 held short-duration post-secondary degrees. Given that 91% of such teachers were 30 to 39 years of age at the time suggests that that younger teachers are unlikely to be those with long-duration degrees.

Norway has a differentiated system of teacher education, which is offered at 32 institutions. These include seven universities, 19 university colleges, two specialist universities, one art college, and three private institutions. The four-year GTE program offered in the 19 university colleges and two of the universities has two parts. Two years are given over to 120 compulsory units, and another two to elective units. The compulsory subjects are Norwegian (30 units), mathematics (30), pedagogy (30), religious and ethical education (20), and basic literacy and numeracy (10). The first 60 elective units must be school-based subjects; the remaining 60 are more broad-ranging.

In 2004, the compulsory sector of Norway's education system had 590,000 students and 85,000 teachers (Ministry of Education and Research, 2004). Uncertified teachers are used to some degree in many schools. These teachers are typically hired on a one-year contract, but only when a certified teacher is not available. Today, school managers/principals seem to have more freedom than previously in hiring these teachers, but once the year is up, principals must make the vacant post public so that qualified teachers can apply. Teachers who are not fully qualified formed approximately six percent of the workforce in 2001 (Lyng & Blitchfeldt, 2003). Of them, nearly 35% went on to acquire full teacher certification.

16 Since 1997, compulsory schooling has been extended to 10 years, and divided into three parts. The first is schooling for young children, 6 to10 years of age. It encompasses Grades 1 through 4. The second is the middle school, which covers children 10 to 13 years of age and consists of Grades 5 to 7. The third is the lower-secondary school, for students ages 13 to 16 in Grades 8 through 10 (Hansen & Simonsen, 2001).

Teacher recruitment and hiring

Legislative and financial control as well as overall responsibility for education lies with Norway's National Assembly (or *Storting*). The Ministry of Education and Research has overall responsibility for all levels of education. Norway is divided into 19 counties, or regional administrative units, and 435 municipalities. The municipalities are responsible for the primary and lower-secondary schools (compulsory education), and their "brief" includes appointing teachers. Although the local government is the formal employer of teachers, applications and hiring decisions take place at the school level. Thus, teachers apply for posted jobs at the school level and the school principal decides whom to hire.[17]

A survey of levels of competence among teachers at the compulsory school level (Ministry of Education and Research, 2004) found that many of the teachers had little formal training in the subjects they teach, especially core subjects such as mathematics, English, and Norwegian. Among the teachers teaching mathematics in primary schools, just over 70% reported having fewer than 30 credits in this subject. The figures for English and Norwegian were 70% and 50%, respectively, with 30 credits apiece. At the lower-secondary level, the corresponding numbers for mathematics, English, and Norwegian were 40%, 25%, and 30%, respectively (Ministry of Education and Research, 2004).

Teachers' wages and workloads in Norway traditionally were determined primarily through contracts negotiated between the teachers' unions and the central government. Until recently, teachers' wages rested solely on the amount of formal education and teaching experience a teacher had, with additions for clearly defined extra tasks and responsibilities (OECD, 2003). Because the national contract effectively prevented schools and school districts from using wage policy to attract teachers, no premiums or bonuses could be offered to teachers of mathematics or other subject areas experiencing teacher shortages.

The situation regarding an undifferentiated salary system has undergone some revision over the last four to five years, with structures being made more flexible and open to variation. Increases in salary are now linked to criteria related to individual performance (Lyng & Blitchfeldt, 2003), in the hope that this incentive will attract teachers into regional and subject areas that face shortages of qualified teachers. Wage flexibility has existed in schools in three counties in the northern part of the country for some time now. Schools in these counties can pay 10% higher wages if they have experienced a shortage exceeding 30% in the past school year (Bonesrønning, Falch, & Strøm, 2003; Falch, 2003). Teachers' unions, however, tend to oppose giving special groups of teachers (such as mathematics teachers) special benefits in times of shortage (Lyng & Blitchfeldt, 2003).

Teacher salaries

Teachers' work time is defined in terms of hours per year, as negotiated between teachers' unions and the central government. Because teacher labor markets (from the standpoint of wage-setting, job definition, and certification) are highly centralized in Norway, the time allocation across tasks is usually uniform throughout the country. Teachers at the primary level are required to allocate 950 hours per year (25 per week) to classroom-

17 A characteristic feature of the formal education system in Norway is the central position held by public authorities and institutions. There is no tradition of private schools, but a few do exist.

based instruction, 190 hours per year to school-organized work collaboration, 37.5 hours to post-secondary/in-service education, and 540 hours to planning (out-of-school work) (Hansen & Simonsen, 2001).

Despite having a comparatively high GDP per capita relative to other OECD countries, Norway spends a comparatively low share of this money on teachers' salaries. Teachers' unions in Norway are committed to parity in teacher salaries. There is no systematic difference in wages between male teachers and female teachers at the compulsory schooling level, nor are there systematic differences in the salaries of primary and lower-secondary school teachers (OECD, 2004).

According to the OECD, teacher salaries in Norway are, on average, below teacher salaries in other OECD countries. In 2000, *starting* salaries in compulsory education were somewhat higher than the OECD average. However, the salary at the top of the scale, for teachers who had completed 15 years in the profession, was 10% to 25% lower than the OECD average (OECD, 2004). The last three to four years have witnessed an increase in teacher salaries in Norway. This increase holds despite an increase over recent years in the hours that teachers typically work. Salary negotiations during 2002 led to an average rise of 7.7% over existing salaries, which had actually begun increasing during the 1996 to 2001 period.

The average annual income and average lifetime incomes of teachers do not compare favorably with those of other professionals with similar qualifications. We asked the Department of Research at the Norwegian Statistics Bureau to estimate detailed age/earning profiles for teachers, engineers, and other scientists relative to short- and long-duration post-secondary education. They took the teacher-related information from the National Educational Database and information on the other professionals from the matched Employer/Employee Register.

Tables 36 and 37 and Figures 46 to 49 show the department's estimates of median annual earnings for teachers, engineers, and "other scientists," according to gender and across two levels of tertiary education. According to the departmental researchers (personal communication):

> Teachers are defined as individuals with relevant education, working in schools. Some effort has also been made to distinguish them from non-teaching staff (principals, advisors, and other administrative staff) by use of data on occupation. Teachers with short tertiary education mostly have Teachers College, while teachers with long education mostly have a university degree and pedagogical training. Engineers are defined from inspection of a more detailed underlying classification, as a sub-group of those having tertiary education in the fields of sciences, vocational and technical subjects. The category other science consists of the rest of all individuals with education within this field.

The age-earnings profiles shown in the tables and figures for full-time employed individuals suggest that males employed in education in 2005 in Norway earned well below the average earnings of science professionals and especially engineers. Data not presented in the tables and graphs show that salaries are even more favorable for engineers and those in other sciences (or with other science degrees) given that engineers and other scientists average about a year less of education than teachers. For example, a typical compulsory school teacher (with a short-duration degree) studies for an average of 16.7 years, whereas an engineer or other scientist undertakes about 15.7 years of educational study. A teacher with a long-duration degree typically studies for 18.8 years, an engineer for 18 years, and a scientist for 18.3 years. Thus, if the differences

Table 36: Norway, Median Annual Earnings of Full-Time Employees with Short Period of Higher Education, by Age, Occupation, and Gender, 2005 (thousands of current 2005 Norwegian kroner)

Age	Teachers (Compulsory Schooling)	Upper-Secondary Teachers	Engineers	Other Science
Males, Full-Time Employed				
25–29	315	309	375	284
30–39	352	370	454	376
40–49	390	411	518	492
50–59	398	419	505	481
60+	398	413	470	461
Females, Full–Time Employed				
25–29	304	285	332	263
30–39	327	340	361	317
40–49	370	388	402	380
50–59	382	402	384	387
60+	382	399	336	389

Source: Estimates prepared by the Research Department at Statistics Norway from Norwegian register data; combines information on education from the National Educational Database and information on industry, work time, and income from the matched Employer/Employee register. The data in principle encompass the entire working-age population. Full-time workers are those registered as working 30 hours per week or more.

Table 37: Norway, Median Annual Earnings of Full-Time Employees with Long Period of Higher Education, by Age, Occupation, and Gender, 2005 (thousands of current 2005 Norwegian kroner)

Age	Teachers (Compulsory Schooling)	Upper-Secondary Teachers	Engineers	Other Science
Males, Full-Time Employed				
25–29	267	301	386	311
30–39	370	386	534	420
40–49	420	444	665	506
50–59	438	465	667	514
60+	446	460	619	488
Females, Full–Time Employed				
25–29	313	316	372	308
30–39	346	364	469	368
40–49	399	434	572	430
50–59	426	453	581	448
60+	429	446	470	448

Source: Estimates prepared by the Research Department at Statistics Norway from the Norwegian register data; combines information on education from the National Educational Database and information on industry, work time, and income from the matched Employer/Employee register. The data in principle encompass the entire working-age population. Full-time workers are those registered as working 30 hours per week or more.

Figure 46: Norway, Median Annual Earnings of Males with Short-Course Higher Education, by Age and Occupation, 2005

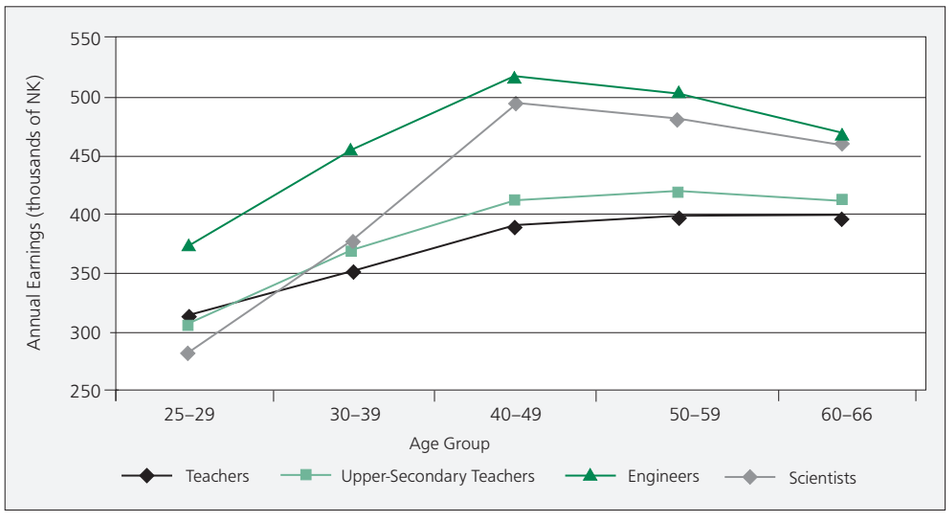


Figure 47: Norway, Median Annual Earnings of Females with Short-Course Higher Education, by Age and Occupation, 2005

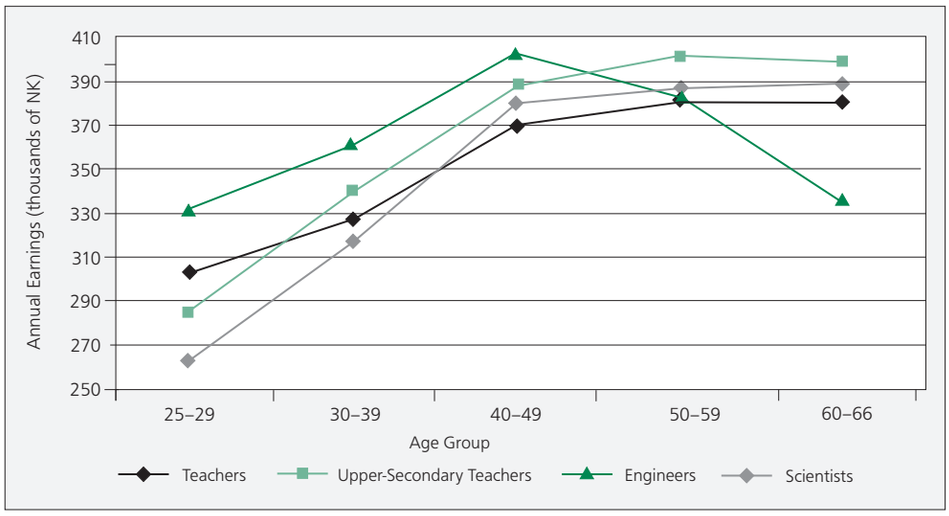


Figure 48: Norway, Median Annual Earnings of Males with Long-Course Higher Education, by Age and Occupation, 2005

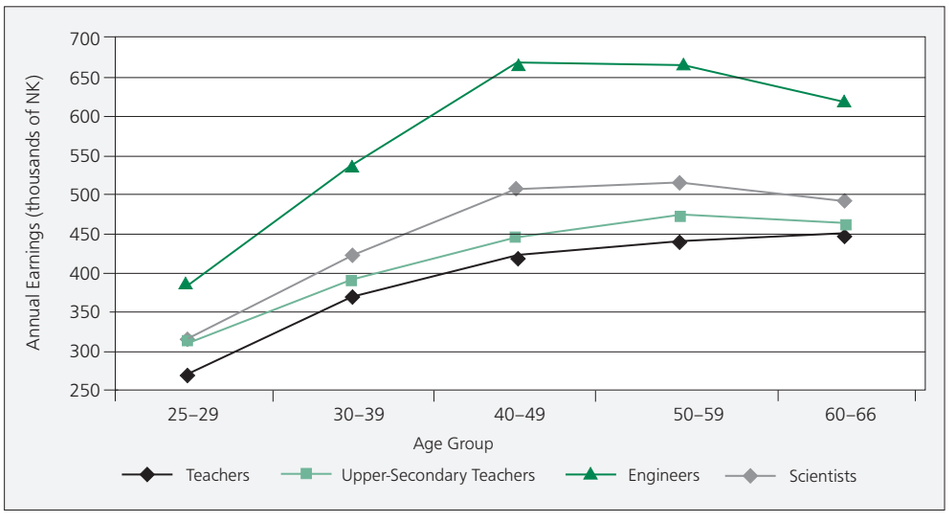
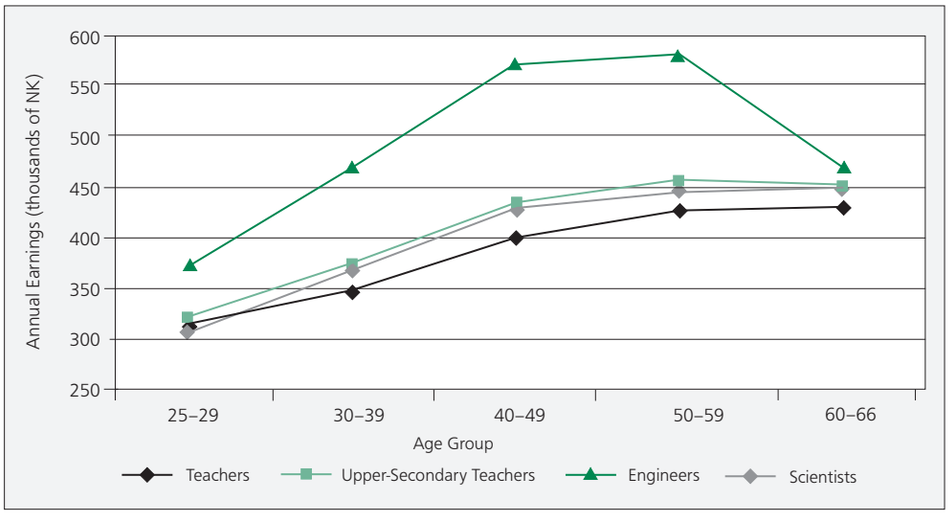


Figure 49: Norway, Median Annual Earnings of Females with Long-Course Higher Education, by Age and Occupation, 2005



shown in the tables and figures were corrected for differences in years of education, they would be greater.

For females, the differences in salaries between teachers and competing mathematics-intensive professions are much smaller. Whereas female engineers earn more than both compulsory and upper-secondary teachers, teachers—especially upper-secondary teachers—earn salaries that are comparable to those of scientists. However, as is the case with males, each of the education categories has female engineers and scientists with about six months to one year less of education.

These results suggest that some of the shortage of mathematics teachers may be due to current salary levels. This supposition seems especially valid at the upper-secondary level, where the majority of teachers are male. Here, male teachers with mathematics skills face a large salary gap relative to other mathematics-oriented professionals.

References

Arnesen, C. Å. (2002). *Flukt fra lærer og førskolelæreryrket?* (*Escape from teaching and preschool teaching?*) (NIFU skriftserie 8/2002). Oslo: Norwegian Institute for Studies in Research and Higher Education.

Bonesrønning, H., Falch, T., & Strøm, B. (2003). T*eacher sorting, teacher quality, and student composition: Evidence from Norway* (working paper series). Oslo: Department of Economics, Norwegian University of Science and Technology.

Falch, T. (2003). *Estimating the elasticity of labor supply to an enterprise utilizing a quasi-natural experiment* (working paper series). Oslo: Department of Economics, Norwegian University of Science and Technology.

Hansen, A., & Simonsen, B. (2001). Mentor, master and mother: The professional development of teachers in Norway. *European Journal of Teacher Education, 24*(2), 171–182.

Lyng, S. T., & Blichfeldt, J. T. (2003). *Attracting, developing and retaining effective teachers: Country background report for Norway*. Oslo: Work Research Institute. Retrieved May 25, 2009, from http://www.oecd.org/dataoecd/62/23/2635707.pdf.

Ministry of Education and Research. (2004). *Country report: Language education policy profile 2003–04*. Oslo: Author.

Ministry of Education and Research. (2009). *Report No. 11 (2008–2009) to the Storting: The Norwegian Government's white paper on teacher training*. Oslo: Author.

Organisation for Economic Co-operation and Development (OECD). (2004). *Education at a glance 2004*. Paris: Author.

Philippines

Composition of the teacher labor force

Total primary and secondary school enrollments in the Philippines reached 12.1 million and 5.0 million during 2003 and 2004 respectively. The corresponding numbers of public primary and secondary school teachers numbered 337,597 and 120,685, with an additional 70,066 teachers in private institutions (Department of Education, 2009). In 1991, almost all teachers in basic education were female, but by 2004 the proportions of female primary and secondary school teachers had dropped to just over 89% and just under 76% respectively.

According to the Bureau of Labor and Employment Statistics (BLES) (2003), the size of the teacher labor force has been relatively stable in recent years, with a net increase of approximately 70,000 teachers from 1991 to 2000. With more than 35,000 new teacher education graduates over each year of this period, and a slight, concurrent increase in the student–teacher ratio (BLES, 2003), one might assume a substantial surplus of primary and secondary school teachers. In fact, estimates suggest that around 30% of teacher education degree-holders work outside of teaching (BLES, 2003).

In 1997, the Commission on Higher Education noted that about 25% of high school students who had passed the national college entrance examination wanted to become teachers, and that about 71% of teacher education program entrants actually completed their degrees (Agarao-Fernandez & Guzman, 2005). Also, about two-thirds of entrants at the time studied to become primary school teachers, while the other third entered secondary school teaching programs. Since the 1970s, the teaching profession has become associated with relatively low earnings and social status, and teacher education programs are consequently thought to attract academically weaker students (Agarao-Fernandez & Guzman, 2005; Bautista, 2003).

Because of the social and economic disadvantages associated with the teaching profession, some commentators posit that many individuals with teaching degrees are reluctant to enter teaching (see, for example, Agarao-Fernandez & Guzman, 2005). Although the Philippines has a relatively old teaching force, with 43% of primary school teachers 50 years of age or over and nearly 127,000 primary and secondary school teachers possibly retiring in the next few years, the school system may still have difficulty attracting a sufficient number of qualified teachers to fill those places (Agarao-Fernandez & Guzman, 2005; UNESCO Institute for Statistics, 2006).

Mathematics education and science education, for example, have been served particularly poorly in recent years, mainly because of significant shortages of qualified teachers. The most recently available data suggest that only about 1.5% of secondary education degree holders have science or mathematics as their majors (Agarao-Fernandez & Guzman, 2005). The current pool of physics and chemistry teachers in particular possesses few individuals who majored in physics or chemistry; as a consequence, these subjects tend to be taught in a rote or boring manner (Somerset and colleagues, cited in Agarao-Fernandez & Guzman, 2005). Rather than experiencing an integrated program for science instruction, the few students who want to become physics teachers usually enroll in the regular college physics sequence and add on general teaching methods courses (van den Berg, Locaylocay, & Gallos, 2006). Many mathematics teachers who are graduates of non-education degree programs that include at least five college subjects

in higher mathematics are certified to teach this subject in secondary school after taking five education courses and teaching practicum(s), and passing the licensure examination for teachers (LET-mathematics). It seems that attracting qualified mathematics and science teachers will be a necessary and key focus of education policy in the Philippines for years to come.

Teacher education and recruitment

Almost all higher education institutions in the Philippines offer standard four-year teacher education programs with relatively low tuition rates.[19] Most primary and secondary school teachers earn Bachelor's degrees in, respectively, elementary or secondary education; very few individuals earn Master's degrees. Upper-secondary school teachers also study a major and minor field as part of their secondary-level education degree (Agarao-Fernandez & Guzman, 2005). Prospective teachers often take subject specialty courses within their respective education degrees rather than taking separate subject-specific majors.

There is a growing awareness that teacher education in the Philippines needs to transition away from general education and methods courses toward more subject-specific content. For example, in 1997, around 50% of the teacher education program curriculum focused on general education. In 2004, however, the Commission on Higher Education set alternative curricular guidelines that not only balanced the number of general education and subject-content courses but also emphasized professionalism, field study, and special topics courses (Agarao-Fernandez & Guzman, 2005). Unfortunately, because of limited funds, most teacher education programs do not provide practical field training for prospective teachers. In-service teachers have difficultly accessing professional development programs, again because of funding limitations.

Upon graduating, prospective teachers must participate in the challenging LET, which had an annual pass rate of only 25% to 35% from 1996 to 2004 (Agarao-Fernandez & Guzman, 2005). The low pass rate is perhaps due to the tenuous relationship between teacher education programs and examination content, and to the fact that fewer than 30% of the teacher education programs in the Philippines meet the minimum benchmark of the Commission for Higher Education. Many teachers secure their civil service status by fulfilling the alternative requirement of teaching for over 10 years; eventually, more than 70% of teachers do pass the examination (BLES, 2003).

In terms of recruitment, the Department of Education hires the largest proportion of teachers. In 1998 alone, the department recruited over 300,000 teachers and 33,000 administrative or supervisory staff (Acedo, 1999). The department's hiring process generally accounts for around 80% of its budget, crowding out funds that could improve other areas of education (Acedo, 1999). Acedo also noted in her 1999 report that teachers hired by the department had been inefficiently allocated in the previous years, either because of administrative policies or the 1966 "Magna Carter for Teachers," which stipulates that teachers must agree to transfer to other schools as directed. According to Acedo, local school boards were using local funds to hire "supplementary teachers" to fill their community's unmet preferences or needs, a practice that continues today. These teachers are paid less because of limited local funds, even though they are (arguably) of comparable caliber to the teachers hired by the Department of Education.

19 About 85% of the higher education institutions that provide teacher education programs are private; the rest are public. In addition, each region of the Philippines has at least 15 higher education institutions that provide teacher education programs (Agarao-Fernandez & Guzman, 2005).

Teacher salaries and workload

Primary and secondary school teachers in the Philippines have similar salary schedules. A teacher with a minimum teaching qualification earns roughly 2.05 times the GDP per capita as a starting salary, 2.26 times the GDP per capita after 15 years of experience, and 2.43 times the GDP per capita after 30 years of experience (UNESCO Institute for Statistics, 2006). A teacher with maximum qualifications and 30 years of experience earns a salary that is 3.66 times the GDP per capita (UNESCO Institute for Statistics, 2006). In terms of international PPP dollars, the average salary for a primary or secondary school teacher with minimum qualifications is $9,418 if that teacher has no years of experience, $10,396 if he or she has 15 years of experience, $11,195 if he or she has 30 years of experience, and $16,833 if he or she has 30 years of experience and maximum qualifications (UNESCO Institute for Statistics, 2006). To move from the minimum to the maximum salary, teachers need to have been teaching, on average, for 22 years (UNESCO Institute for Statistics, 2006).

Agarao-Fernandez and Guzman (2005) note that a public school teacher's maximum salary is only P10,000, well under the National Economic and Development Authority's basic living standard of P16,710 for an average family. Teachers, they observe, may not only experience difficulty meeting their basic household needs but also have to purchase their own teaching materials. Finally, teachers generally receive non-wage benefits and bonuses only if their work is outstanding or if they obtain higher education degrees beyond the basic requirement (UNESCO Institute for Statistics, 2006). Mathematics and science teachers do not seem to earn additional benefits or bonuses, even though they are generally in shorter supply. In the Philippines (as in other countries), teachers are not paid on the basis of the subjects they teach but according to the level of the education system they teach, that is, primary, secondary, or tertiary.

To compound the salary issue, teachers in the Philippines face a heavy workload in terms of work hours and class sizes. Primary and lower-secondary school teachers are required to work 196 days out of the school year for 30 hours per week, while upper-secondary teachers are required to work 25 hours per week. However, the number of hours each year that teachers in the Philippines teach is considerably more than the hours taught by their colleagues in most other East Asian countries (UNESCO Institute for Statistics, 2006).

In 1998, the Teacher Education Commission broke down the weekly teaching load of a typical teacher in the Philippines as follows: 20 hours of actual teaching, 15 hours of preparation and grading, and 10 hours on other tasks. According to the commission, teachers at this time were working more than the 40-hours-per-week civil-service requirement (Education Commission, cited in Agarao-Fernandez & Guzman, 2005). From what we understand, the situation is much the same today. Furthermore, class sizes in both primary and secondary schools are relatively large, with an average of 42 students per class in the former and 36 in the latter in 2004 (UNESCO Institute for Statistics, 2006). Many classes in urban areas have 60 to 75 students. These large numbers very likely act as a further deterrent to anyone considering entering mathematics teaching.

We estimated and compared the salaries of teachers with the salaries of two other occupations for two years, 2001 and 2006. Our estimates suggest that both male and female teachers are paid better than university graduates who are not scientists, but

considerably less than university graduates who are scientists.[20] This pattern was evident in both years. Our results also showed that teacher salaries remained approximately constant in the five-year period, whereas the salaries of other university graduates (particularly for those in the younger age cohorts) rose. Thus, in relative terms, teachers lost ground between 2001 and 2006. Table 38 presents monthly mean incomes in US dollars and Figures 50 to 53 graph monthly median incomes in US dollars.

Table 38: Philippines, Mean Monthly Earnings of College Graduates, by Gender, Age, and Occupation, 2001, 2006 (current US dollars)

	Males			Females		
Age	*Teachers*	*Scientists*	*Non-Scientists*	*Teachers*	*Scientists*	*Non-Scientists*
2001						
20–24	214	265	139	233	191	150
25–29	249	283	173	257	235	188
30–34	250	325	197	255	260	202
35–44	274	433	227	277	378	243
45–54	301	396	253	294	410	268
55–64	300	461	309	295	191	298
2006						
20–24	211	248	197	189	246	177
25–29	243	334	214	227	288	242
30–34	257	381	261	254	314	283
35–44	267	385	281	271	317	265
45–54	301	561	428	290	314	293
55–64	311	411	414	320	274	323

Source: Estimates from the Labor Force Survey data for the first quarter of 2001 and the first quarter of 2006 provided by the National Statistics Office, Income and Employment Statistics Division.

20 These estimates are from a labor force survey and therefore include all teachers, in both public and private schools. Teacher salaries in private schools tend to be lower than in public schools, but three of every four employed teachers teach in public schools.

Figure 50: Philippines, Median Monthly Earnings of Male College Graduates, by Age and Occupation, 2001

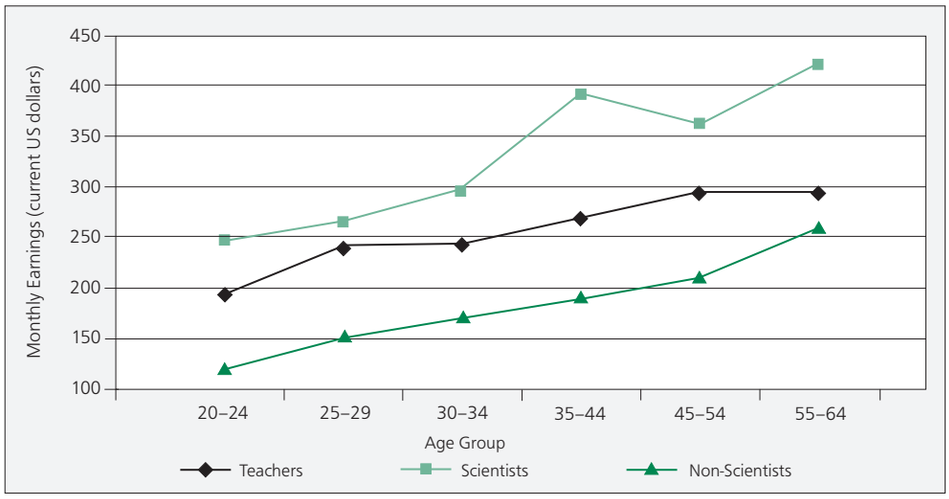


Figure 51: Philippines, Median Monthly Earnings of Female College Graduates, by Age and Occupation, 2001

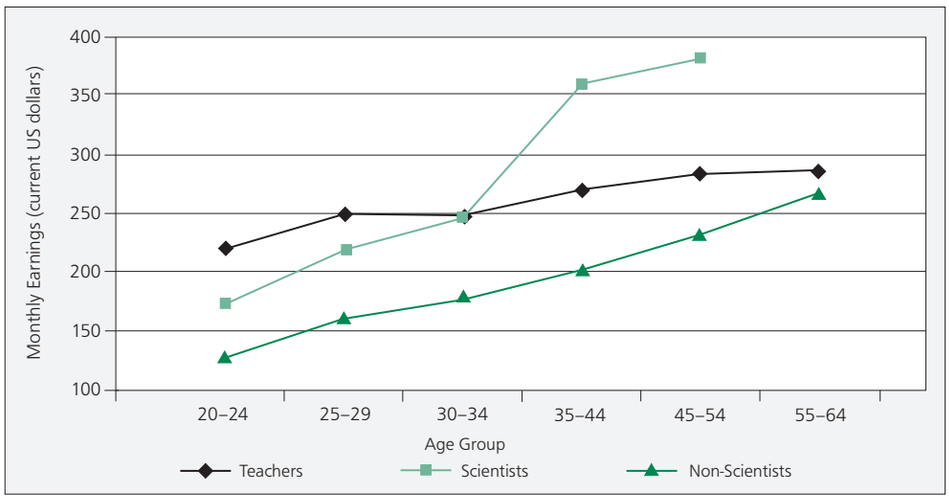


Figure 52: Philippines, Median Monthly Earnings of Male College Graduates, by Age and Occupation, 2006

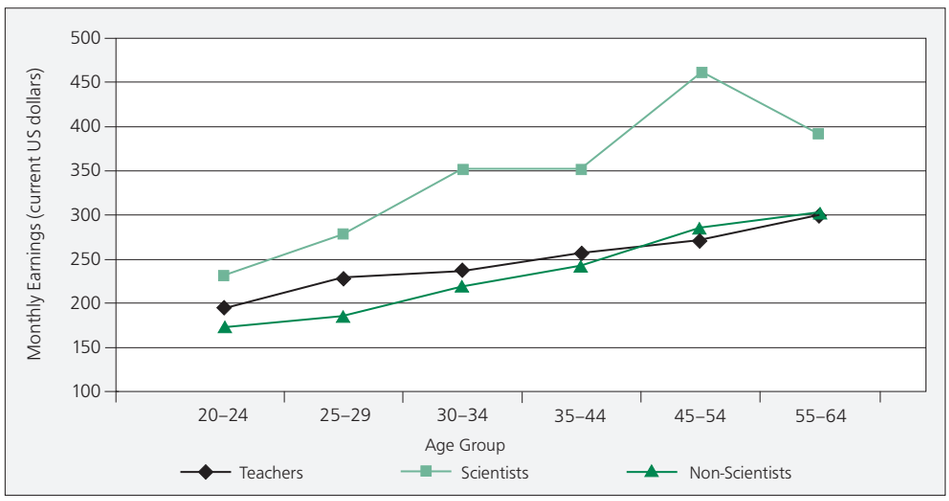
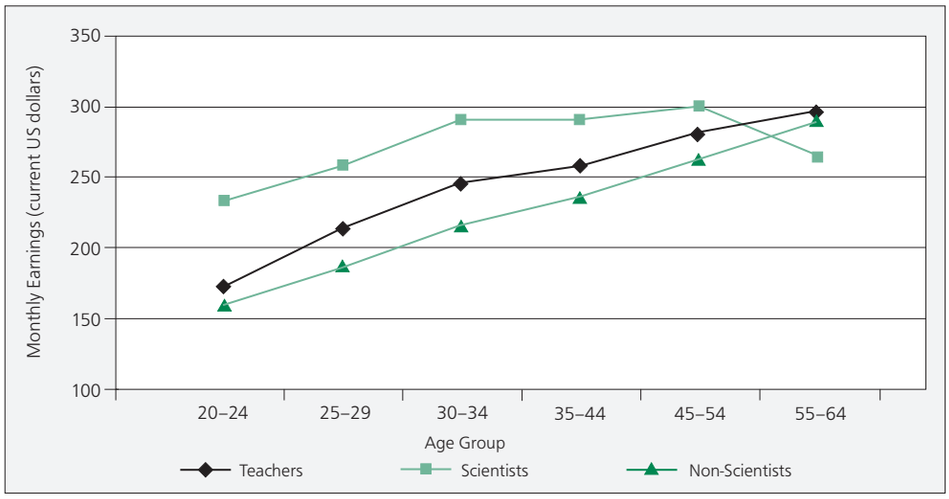


Figure 53: Philippines, Median Monthly Earnings of Female College Graduates, by Age and Occupation, 2006



References

Acedo, C. (1998). *Teacher supply and demand in the Philippines*. Washington, DC: Human Development Network in Education (HDNED), the World Bank.

Agarao-Fernandez, E., & Guzman, A. (2005). Contextual realities of teacher education in the Philippines. *Educational Research for Policy and Practice, 4*, 129–144.

Bautista, K. (2003). Overhauling RP education. *Magazine MIND: Your guide to Lifelong Learning, 1*, 12–16.

Bureau of Labor and Employment Statistics. (2003). Supply and demand situation for teachers. *Labstat Updates, 7*(12).

Department of Education. (2009). *Philippines. Quick counts data, 2003–2004*. Retrieved August 18, 2009, from http://www.deped.gov.ph/quicklinks/quicklinks2.asp?id=12.

UNESCO Institute for Statistics. (2006). *Teachers' statistical tables*. Retrieved from http://www.uis.unesco.org/ev_en.php?ID=6515_201&ID2=DO_TOPIC.

van den Berg, E., Locaylocay, J., & Gallos, M. (2006). A physics teacher education program in the Philippines. *APS Forum on Education*, Spring. Retrieved May 25, 2009, from http://www.aps.org/units/fed/newsletters/spring2006/index.html.

Singapore[21]

Composition of the teacher labor force

The 2005 education statistics documented 26,382 teachers in Singaporean government schools (Ministry of Education, 2008). This figure constituted a 27% increase in the number of teachers over the previous 10 years, and the Ministry of Education plans to have 30,000 teachers in place by 2010, an increase of about 3,000. According to data provided by the Ministry of Education, the rate at which teachers resign from the service has been steady at between two to three percent per year; the number of teachers who enter the profession each year averages 2,300 teachers.

At the primary school level, approximately 83% of the teaching force is female. The percentage at the secondary level is about 65%. There are approximately 400 expatriate teachers in Singapore, but they make up less than one percent of the education service. About 23% of the total teaching population is made up of mid-career individuals.

The Singapore Government recently initiated a number of programs designed to enhance teachers' professional and personal development and their remuneration packages. Two such packages are GROW (Growth, Recognition, Opportunities, Wellbeing) and the CONNECT plan (CONtiNuity, Experience, and Commitment in Teaching). By offering teachers professional and financial incentives, the government hopes to make teaching an attractive profession for well-qualified individuals. The MOE also offers a variety of awards and scholarships to attract ("green harvest") top pre-university students into teaching. These incentives include sponsoring prospective teachers to study in top universities locally and overseas.

Teacher education

Teacher education in Singapore is provided by the National Institute of Education, which specializes in teaching pedagogy/curriculum proficiency and is an autonomous institute of Nanyang Technological University. Entry requirements for the Diploma of Education (two years) or Bachelor's programs (four years) are good results for the General Certificate of Education (GCE) "A" level or possession of a polytechnic diploma. A significant entry qualification not required in many other countries is that all trainee teachers must pass mathematics at the GCE "O" level. [22]

The Bachelor in Education (arts/sciences) program prepares primary school teachers to teach two or three subjects and secondary school teachers to teach one major and one minor subject. The program includes courses in education studies, curriculum studies, subject knowledge, academic studies, and a practicum component.

---

21 Unless stated otherwise, information for this section was drawn from these websites:
http://www.nie.edu.sg/itt_hb/web/2006/gi06/untrain.html
http://www.nie.edu.sg/itt_hb/web/2006/gi06/trained.html
http://www.moe.gov.sg/teach/
http://www.moe.gov.sg/teach/AdmissionCriteria.htm
http://www.stu.org.sg.

22 In Singapore, primary education covers a period of six years of compulsory education, culminating with the Primary School Leaving Examination (PSLE). The first four years constitute the foundation stage; the next two are known as the orientation stage. The overall aim is to give students a solid background in English, mathematics, and their mother tongue. Secondary education encompasses a four- to five-year period during which students are placed in different tracks based on their performance in the PSLE. Successful completion of this stage leads to the General Certificate of Education "O" level. The General Certificate of Education "A" level is awarded after the O-level stage and after completion of a two-year course at a junior college or a three-year course at a centralized institute.

Education studies courses provide student teachers with a strong understanding of key educational theories and practices and the Singapore education system. Curriculum studies courses deal with the pedagogy of the selected school subjects, including use of ICT, curriculum analysis, and classroom techniques. Subject-knowledge courses help the student teachers gain a deeper understanding of the contents of the school subjects they are trained to teach. These courses align with the respective curriculum studies courses. This combination is an innovative feature found in the teacher education programs of only a few countries around the world. Academic studies courses are traditional tertiary courses that provide in-depth mastery of the respective disciplines. Students focusing on mathematics study calculus, linear algebra, statistics, operations research, analysis, and so on.

The practicum component requires pre-service teachers to spend time in the assigned schools developing teaching skills and linking theory to practice. This component has recently been revised to include three special courses: communication skills for teachers (including voice skills for teaching), academic discourse skills, and group endeavors in service learning (GESL). GESL involves group project work within the context of community service. It aims to develop collaborative skills and project management skills, so that the student teachers can supervise similar projects in the schools after they graduate.

The Diploma in Education and the Postgraduate Diploma in Education are similar in approach and organization to the Bachelor of Education.

Relatively few school teachers in Singapore hold a Master's degree. The most recently available figures show that, at the primary level, 205 teachers out of 12,343 (1.6% of the cohort) have a Master's degree. At the secondary level, 802 out of 11,495 (approximately 7% of the cohort) have this qualification.

The Ministry of Education gives high priority to the professional development of Singaporean teachers. Each teacher, in consultation with his or her immediate supervisor, identifies the training he or she plans to undergo each year and sets this out on a personal "training road map." All teachers in Singapore are encouraged to attend up to 100 hours (12.5 days) of professional development per year. This measure was put in place to ensure that every teacher has sufficient opportunity to engage in ongoing education. The ministry provides teachers with a variety of incentives and pathways so that they can systematically upgrade their professional knowledge and practices and obtain advanced certification.

Teacher recruitment and hiring

The Ministry of Education is the formal employer of all government school teachers. Recruitment and hiring are thus centralized functions. In Singapore, people interested in becoming teachers in government schools must first apply to the ministry for positions as trainee teachers. Selection is based on academic qualifications, non-academic experiences, and interviews, which, among other considerations, assess the candidate's communication skills and interest in teaching. The successful candidates are admitted to the National Institute of Education for their pre-service education. While at the institute, the pre-service teachers have their tuition fees paid by the ministry, and they receive a salary. On graduating, the newly qualified teachers must serve as teachers in government or government-aided schools for a period ranging from three to five years, depending on the program completed.

Through its Education Service Professional Development and Career Plan (Edu-Pac), the ministry provides three career tracks for its teaching personnel—the teaching, leadership, and senior specialist tracks. Staff can move laterally across the tracks (for example, a senior teacher becoming a head of department or a teacher becoming a senior specialist) as long as they satisfy the standards and criteria (qualifications, accreditation, and the like) of the job/career track they want to enter.

The teaching track caters to the majority of staff who want to make classroom teaching their career. Some look forward to career advancement as senior teachers and eventually master teachers. The leadership track caters to those who take on leadership roles in the schools (from subject heads to principals) and various divisions at ministry headquarters (from cluster superintendents to directors). Finally, the senior specialist track comprises staff who have acquired in-depth knowledge and skills in four education-related areas—curriculum and instructional design, educational psychology and guidance, educational testing and measurement, and educational research and statistics.

Teachers have access to many professional development opportunities to enable them to enhance their talents, interests, and professional skills so they can make useful contributions in the track of their choice. These opportunities include an entitlement of up to 100 hours of training (which may lead to an upgrading of qualifications from diploma to Bachelor's or from Bachelor's to Master's), training-related expenses, a professional development leave scheme, and sabbatical leave.

Teacher salaries

Teachers are paid according to the terms of an annual contract. Gross starting salaries vary according to (i) whether the teacher is undergoing or has undergone teacher education, and (ii) the program of study (Bachelor of Education, postgraduate diploma, or Diploma in Education). Depending on the qualifications with which they enter the teacher education program, teachers are appointed at either the General Education Officer 1 (GEO1) level or the General Education Officer 2 (GEO2) level. When teachers complete their education, their salary is increased to reflect the new qualification.

In 2007, the starting monthly salaries of trainee teachers in GEO1 was set at $S2,472 (Bachelor's degree) and $S2,822 (Bachelor's degree with honors). Males who have completed National Service receive extra money. Under the GEO2 provision, the salary range is $S1,431 to $S1,978, depending on each person's academic qualifications. Again, males who have completed National Service receive extra. Starting salaries are the same whether the teachers teach in primary or secondary schools or JC/CI.

Teachers are offered three kinds of bonus. These include a variable non-pensionable annual allowance (NPAA), which is usually equivalent to one month's gross salary, and an annual variable component (AVC), given at the end of the year. The AVC sum varies from year to year depending on Singapore's economic performance, and is given to all civil servants. A special bonus is sometimes given as well, but this measure again depends on Singapore's overall economic wellbeing. Teachers are also eligible for performance bonuses, which are awarded in March each year for the work done during January to December of the previous year. The amount given usually corresponds to a month's salary or six weeks of salary.

The bonus payments provide teachers with an incentive to stay in the profession. The government's CONNECT plan has the same aim. Under this scheme, a sum of $S2,400 to $S6,200 is set aside every year for each teacher. Teachers can draw on their CONNECT accounts at designated points every three to five years. In 2006, the ministry announced it was increasing the amount deposited in these accounts by between 20% and 30%.

Table 39 shows the starting monthly salaries of pre-service and newly graduated teachers when bonuses and the CONNECT plan deposits are taken into account. The figures relate to 2007 and are given in Singapore dollars. Table 40 sets out the monthly and annual (including all bonuses) modal salaries (i.e., the salary level featuring the main cluster of teachers in that age range) of trained graduate classroom teachers in 2007 by age group. Monetary amounts are again given in Singapore dollars.

Table 39: Singapore, Mean Starting Monthly Earnings (Including Bonuses) of Pre-service and Newly Graduated Teachers, 2007 (current Singapore dollars)

Non-Graduate Trainee Teachers with "A" Level Polytechnic Diploma Qualification			Newly Graduated Teachers		
Year of Teacher Education	*Without National Service*	*With National Service*	*Qualification*	*Without National Service*	*With National Service*
One	1,729–2,150	1,916–2,390	Pass/Pass with merit	2,987	3,410
Two	1,823–2,271	2,009–2,510	Honors	3,199–3,410	3,621–3,833

Note: A male graduate joins the Education Service at age 25 after completing National Service.
Source: Data provided by the Ministry of Education, Singapore.

Table 40: Singapore, Modal Monthly and Modal Annual Teacher Earnings (Including Bonuses), by Age, 2007 (current Singapore dollars)

	Modal Monthly Earnings		Modal Annual Earnings (including bonuses)	
Age	*Males*	*Females*	*Males*	*Females*
20–24		2,585		44,268
25–29	3,548	3,548	59,894	59,894
30–34	4,737	4,737	79,324	79,324
35–39	5,796	5,796	94,538	94,538
40–44	6,685	6,685	106,818	106,818
45–49	6,685	6,685	106,818	106,818
50–54	6,685	6,685	106,818	106,818

Source: Data provided by the Ministry of Education, Singapore.

We used these data to estimate approximate age/income profiles for teachers with Bachelor's degrees (trained graduates) in 2004 and then compared that information with information on the earnings of accountants and engineers available from the 2004 employment survey. (To obtain teacher age/income profiles for 2004, we discounted the 2007 modal earnings by 20%, to reflect inflation from 2004 to 2007.) We also assumed that all professionals receive approximately the same bonuses that teachers receive, and accordingly compared base monthly salaries rather than salaries plus annual bonuses, an approach that may have somewhat underestimated teachers' pay relative to the pay of other professionals. In addition, some of the accountants and engineers in the sample may have held graduate degrees, and so would not be strictly comparable with teachers. That said, modal salaries may overestimate means at every age if the mode represents a minority of those working as teachers, and if most teachers work for lower salaries than that minority.

Overall, with the above provisos taken into account, it appears that in 2004/2005, teachers were being paid about the same starting salaries as accountants but lower starting salaries than engineers (Table 41 and Figures 54 and 55). But if teachers teach into their 40s, they seem to do better than both accountants and engineers. Also, the vast majority of teachers in Singapore are women, and their pay is similar to that of women in other mathematics- and science-oriented professions. Taken together, these considerations suggest that young people have adequate financial incentive to become teachers.

Table 41: Singapore, Mean Monthly Earnings, by Age, Gender, and Occupation, 2004

	Females with College Degree			Males with College Degree		
Age	*Teachers*	*Accountants*	*Engineers*	*Teachers*	*Accountants*	*Engineers*
20–24	2,154	2,130	2,976		2,135	2,862
25–29	2,957	3,351	3,296	2,957	2,964	3,305
30–34	3,948	4,002	3,807	3,948	4,086	4,018
35–44	5,200	4,318	4,209	5,200	4,271	4,622
45–54	5,571	4,886	4,298	5,571	4,756	5,056
55+	5,571	n.a.	n.a.	5,571	5,054	5,182

Note: n.a. = not applicable.

Source: Ministry of Education, Singapore (see table of modal salaries), and Labor Survey.

Figure 54: Singapore, Mean Monthly Earnings (Excluding Annual Bonuses) of Males, by Age and Occupation, 2004 to 2005

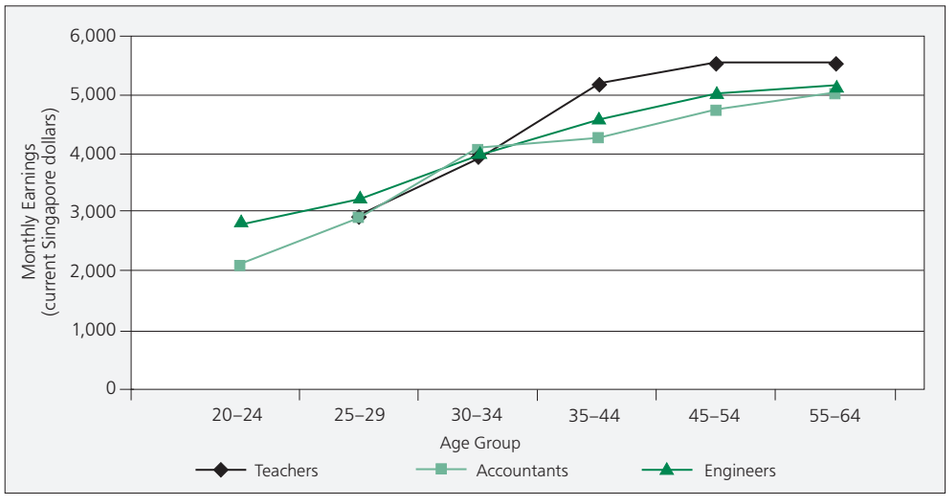
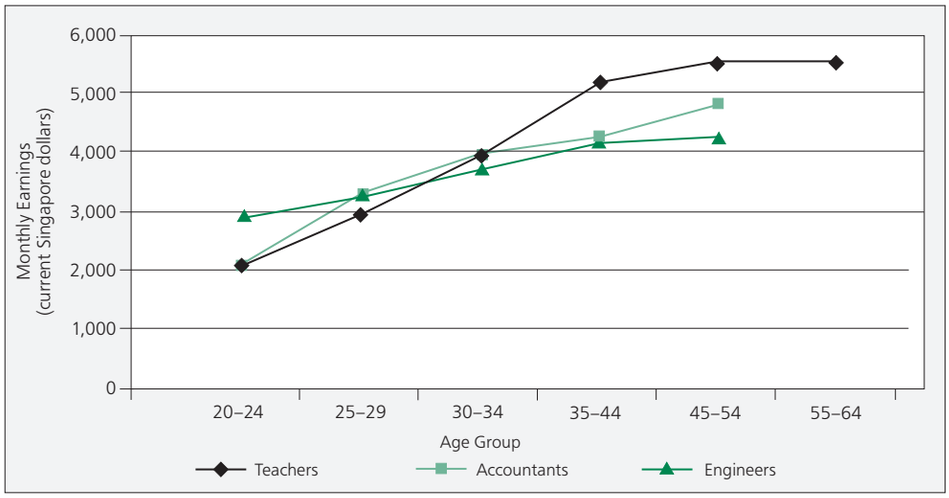


Figure 55: Singapore, Mean Monthly Earnings (Excluding Annual Bonuses) of Females, by Age and Occupation, 2004 to 2005



References

Ministry of Education. (2008). *Education statistics digest*. Singapore: Author. Retrieved August 18, 2009, from http://www.moe.gov.sg/education/education-statistics-digest/esd-2008.pdf.

Ministry of Manpower. (2004). *Occupational survey*. Singapore: Author.

National Institute of Education (2007). *BA(Ed)/B.Sc(Ed) programs, 2006/07*. Singapore: Author.

Spain

Composition of the teacher labor force

According to the *Anuario Estadístico de España 2007* (*Statistical Yearbook of Spain, 2007*), published by the National Institute of Education (2007), the number of students enrolled in Spanish primary schools (both public and private) declined slightly between the mid 1990s and 2004/2005, from about 2.6 million to 2.5 million. Enrollments rose a little in basic- and upper-secondary schools. The number of classroom teachers increased considerably, especially relative to the number of students. Between the mid 1990s and 2004/2005, the number of teachers in non-university public schools increased by nearly 19%. These changes resulted in reductions in student–teacher ratios in preschools and in primary and secondary schools in Spain. Additionally, between the 1994/1995 and the 2004/2005 school years, the number of young people enrolled in teacher preparation programs in Spain increased from 68,748 to 95,550 (Ministry of Education and Science, 2004).

In 2005, about 70% of all primary teachers were women, as were 56% of secondary teachers (Eurostat, 2008). Between 1990 and 2001, the percentage of female students enrolled in primary teacher preparation programs increased from 40.8% to 73%. The relative percentage of females graduating from these programs was even greater than the percentage enrolled, indicating not only that more females than males study to be primary teachers, but also that females are more likely to complete their programs of study. At the secondary level, a much larger proportion of female teachers than male teachers participates in the year-long pre-service course. In 2001, for example, females made up 80% of all students in these courses. Moreover, the number of females in secondary pre-service courses increased by 22% between 1995 and 2001. The number of males studying to be secondary teachers increased by just over one percent (Sanz Vallejo, Ortiz Gordo, & Álvarez Prieto, 2003). These trends indicate a growing feminization of both the primary and secondary teacher workforces in coming years.

In terms of the academic backgrounds of secondary education teachers, prospective teachers tend to come largely from the humanities and social sciences. In 2001, nearly 9.5% of students enrolled in secondary pedagogical aptitude courses had degrees in foreign languages, more than 17% had backgrounds in geography and history, and nearly 19.5% had degrees in language. In contrast, a little over eight percent had degrees in mathematics and just over seven percent had degrees in physics and chemistry (Sanz Vallejo et al., 2003).

Two final features of the teacher workforce in Spain are its relatively low attrition rate and its limited mobility. In the five years before 2003, only about one percent of the public school teaching staff left public school teaching. Workers in the education sector also remained in their profession longer than workers in most other sectors. Additionally, most teachers who left the profession did so because of retirement or ill health. Only in rare cases did teachers apply to permanently leave the profession. Also, although approximately 25% of public school teachers applied for school transfers during the five-year period, fewer than one-third of these teachers were granted their requests (Sanz Vallejo et al., 2003).

Teacher education

Prospective teachers in Spain participate in one of two distinct systems of initial preparation. Those wanting to teach at the preschool or primary level undertake three years of training in the education faculties of universities and receive the degree of *diplomatura*, which is considered a "first-cycle" degree. This degree requires 180 credits of both theoretical and practical training in pedagogy. Prospective secondary teachers study toward a four-year second-cycle university degree in the subject they will teach, followed by a one-year pedagogical aptitude course (Sanz Vallejo et al., 2003).

According to a recent report commissioned by the OECD, these two systems do not completely meet the needs of classroom teachers. While many commentators consider the primary-level training for the *diplomatura* to be inadequate in terms of practical experience and subject-matter knowledge, secondary-level preparation receives criticism for being too academic and not sufficiently oriented toward developing competencies for effective teaching. As a result of the perceived deficiencies of the secondary preparation program, the Ministry of Education and Science, along with collaborating universities, developed a replacement for the pedagogical aptitude course that will prepare teachers more fully for the realities of the classroom (Cros, Duthilleul, Cox, & Kantasalmi, 2004).

Teacher recruitment and hiring

Spanish teachers teaching in public schools (about two-thirds of students in primary and secondary schools attend public institutions) are hired on the basis of a two-part selection process that includes a competitive examination and consideration of candidates' academic records and professional experience. The scores of prospective teachers are then used to compile a list of candidates, with the number of applicants on it not exceeding the number of advertised posts. Teachers are chosen from this list and assigned to schools by regional education authorities. Over the next six months, the new appointees are considered teachers in training. After this time, they officially become permanent civil servants (Sanz Vallejo et al., 2003). In practice, the design of the system is strongly weighted toward the evaluation of teachers' subject-matter knowledge rather than their pedagogical skills or ability because teachers who do not pass the examination stage cannot continue through the process. Also, the period during which these teachers work as teachers in training does not winnow out any who are ineffective teachers (Cros et al., 2004).

In addition to the formal hiring and evaluation process described above, Spain has a system of temporary contracts wherein candidates enter the system to fill short-term vacancies. However, these temporary teachers do not enjoy the same benefits, in terms of stability and salary, as civil servants. The teachers who fill these temporary posts are generally candidates who have not made it to the final candidate list via the competitive evaluation, but are nonetheless deemed competent enough to work in classrooms (Sanz Vallejo et al., 2003).

Teacher salaries

Spanish teachers are paid according to a fixed schedule in which teachers receive, every six years, points and commensurate salary increases based on their hours of in-service professional development and their teaching duties and activities. Teachers can also receive salary bonuses for participation in specific and additional professional development activities, assumption of managerial duties, and teaching in disadvantaged

areas. Teachers wishing to increase their salaries can also, through a competitive process, become school inspectors or school administrators (Cros et al., 2004).

Spanish teachers earn salaries that are generally above the average of OECD countries. In 2005, beginning Spanish teachers at the lower-secondary level earned, in terms of PPP dollars, $35,840, compared to the OECD average of $29,772. Spain's salary complement at the lower-secondary level was, in fact, the fourth highest among OECD countries, below only Luxembourg, Switzerland, and Germany. Using the ratio of salary to GDP per capita, we established that Spain's 2003 ratio of 1:52 at the lower-secondary level (after 15 years of experience) was higher than the OECD average ratio of 1:30. However, the premium for experience, as measured by the ratio of the highest salary (after 39 or more years of experience) to the lowest (beginning salary), was lower in Spain (1:45) than in the OECD countries (1:71) (OECD, 2007).

Although Spanish teachers enjoy a relatively small premium for their experience, lower- and upper-secondary teachers earn considerably more than primary teachers for the time they spend teaching. In 2005, Spanish upper-secondary teachers with 15 years of experience earned $61 per hour of net teaching time, compared to $58 for lower-secondary teachers and $42 for primary teachers with the same level of experience. In percentage terms, upper-secondary teachers with 15 years of experience earned 46% more per teaching hour than primary teachers with the same experience, somewhat higher than the OECD average of 42% more (OECD, 2007). Of course, teaching hours are not equivalent to working hours: in 2003, both primary and upper-secondary teachers in Spain were required to work 1,140 hours at their schools each year (OECD, 2007).

Despite the relatively good salaries earned by teachers in Spain, trends over time indicate that the fortunes of Spanish teachers are actually decreasing. Between 1996 and 2002, Spain was the only country among both OECD member and partner countries to experience decreases in real salaries at both the primary and upper-secondary levels. In fact, real salaries for Spanish teachers at primary and secondary levels fell by seven percent during this period. The ratio of teacher salaries to GDP per capita also decreased between 1994 and 2001 (OECD, 2004).

While the discussion above uses national averages, there is considerable variation in salaries across Spain's regions. For example, primary teachers in Asturias earn the highest salaries of all regions, while Ceuta and Melilla pay the lowest salaries. Among secondary teachers, the Basque Country pays the highest salaries, while Andalucía, Ceuta, and Melilla pay the lowest salaries. There are also interesting cross-regional differences in the salary range between beginning and experienced teachers. This difference is smaller in the Basque Country (25%) and the Canary Islands (nearly 26%) and larger in Andalucía (just under 50%), the Balearic Islands (57%), and Ceuta and Melilla (almost 50%). These differences suggest that, in the former regions, officials hope to recruit new teachers, while in the latter, they hope to retain more experienced teachers (Sanz Vallejo et al., 2003).

Although we were able to obtain data from the 1995 and 2002 employment surveys for Spain in order to conduct comparisons of relative teacher salaries across the two years, we encountered a major problem with the 1995 data. For some reason, the survey excluded the education sector as well as public administration, agriculture, and one or two other sectors. So we had on hand only 15 "secondary teachers" (code 22 in the

survey) and only 48 "primary teachers" (code 28). Also, the education codes were very different for 2002, adding to the difficulty of producing meaningful comparisons. For these reasons, we estimated only the comparative age-earnings profiles for 2002. Data from the OECD (2007) suggest that teacher salaries (corrected for inflation) in Spain declined in real terms between 1996 and 2005, a pattern that contrasts with rising teacher salaries in a number of other OECD countries.

The results of our estimates (Table 42 and Figures 56 and 57) suggest that Spanish primary and secondary school teachers are paid considerably less than scientists and engineers after age 30. The gap is particularly large for males. These low salaries for teachers strongly indicate that young people with better mathematics skills are less likely to enter teaching than to enter these other, higher-paying occupations.

Table 42: Spain, Mean Annual Earnings, by Gender, Level of University Education, Age, and Occupation, 2002 (euros)

	Male First-Cycle University Graduates			Female First-Cycle University Graduates		
Age	*Primary Teachers*	*Scientists & Engineers*	*Business & Social Scientists*	*Primary Teachers*	*Scientists & Engineers*	*Business & Social Scientists*
20–24	12,482	18,006		12,206	13,730	9,765
25–29	17,760	22,580	16,654	17,409	20,303	19,713
30–34	21,062	28,150	22,904	18,764	26,498	26,787
35–44	22,697	39,845	42,343	21,071	28,521	29,497
45–54	24,573	48,743	38,893	23,777	50,623	33,573
55–64	26,279	47,647	43,244	23,963	38,713	
	Male Second-Cycle University Graduates			Female Second-Cycle University Graduates		
Age	*Secondary Teachers*	*Scientists & Engineers*	*Business & Social Scientists*	*Secondary Teachers*	*Scientists & Engineers*	*Business & Social Scientists*
20–24	14,964	20,599	11,750	13,831	17,762	13,592
25–29	18,105	25,100	20,931	17,569	23,308	20,122
30–34	21,608	34,636	38,150	21,162	29,974	27,344
35–44	24,166	50,515	56,581	22,958	39,876	41,692
45–54	27,336	59,550	53,601	26,400	42,631	36,952
55–64	32,552	66,183	81,800	26,574	50,840	38,872

Source: Estimates from National Statistics Institute Salary Structure 2002 database.

Figure 56: Spain, Median Annual Earnings of Male Second-Cycle University Graduates, by Age and Occupation, 2002

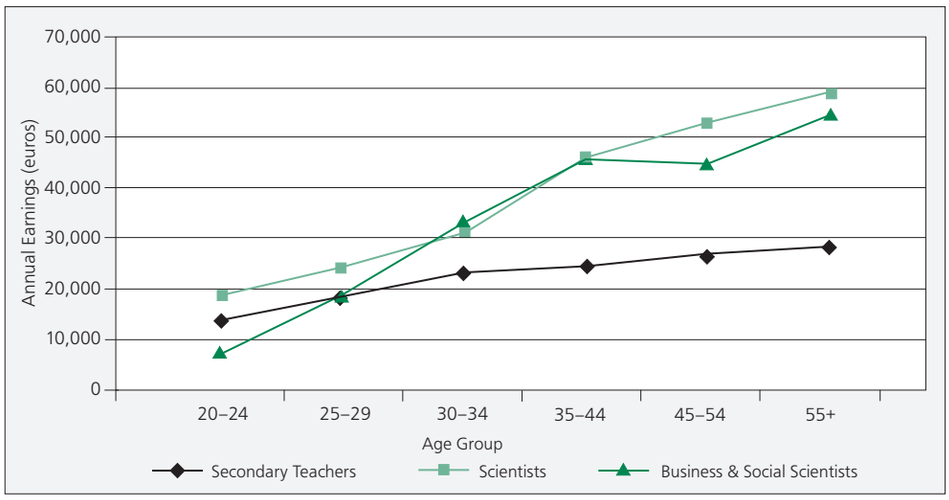
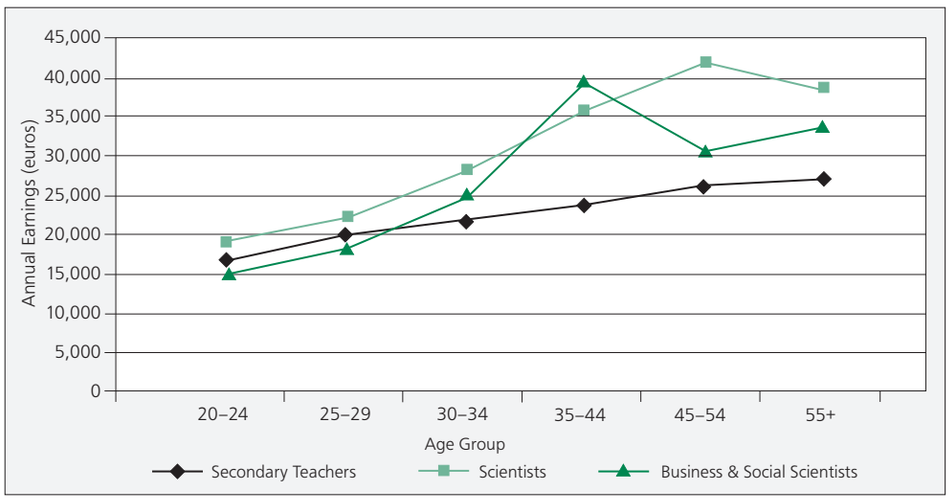


Figure 57: Spain, Median Annual Earnings of Female Second-Cycle University Graduates, by Age and Occupation, 2002



References

Cros, F., Duthilleul, Y., Cox, C., & Kantasalmi, K. (2004). *Attracting, developing, and retaining effective teachers. Country note: Spain*. Paris: Organisation for Economic Co-operation and Development (OECD).

Eurostat. (2008). *Website*. Retrieved January 10, 2008, from http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL.

Ministry of Education and Science. (2004). *Datos y Cifras del curso escolar (School data and figures) 2004–2005*. Madrid: Author.

National Institute of Education (INE). (2007). *Anuario Estadístico de España 2007 (Statistical yearbook of Spain)*. Madrid: Author.

Organisation for Economic Co-operation and Development (OECD). (2004). *Education at a glance. Education indicators 2004*. Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2007). *Education at a glance. Education indicators 2007*. Paris: Author.

Sanz Vallejo, V., Ortiz Gordo, E., & Álvarez Prieto, J. J. (2003). *Attracting, developing, and retaining effective teachers: OECD country background report for Spain*. Madrid: Ministry of Education, Culture, and Sports.

Switzerland[23]

Composition of the teacher labor force

The labor market for teachers in Switzerland is stratified according to level of education, type of program, type of provider (public or private), region of the country (cantons and communes), and subject matter (OECD, 2004a). Any imbalance between supply of teachers and demand relates to imbalances in different sub-markets for teachers.

Results from the OECD International Survey of Upper Secondary Schools (ISUSS) indicated that, in 2001/2002, the percentage of full-time equivalent teaching positions to be filled stood at 13.9% of the total full-time requirement. This percentage was above the OECD country mean of 12.3% (OECD, 2004a). Qualitative shortages were also evident, although more at the lower-secondary and upper-secondary level than at the primary level.

Although difficulties in recruiting teachers exist at different levels of the labor market, the situation is worst at the lower-secondary level. Each advertised position typically attracts between only one and five applicants, limiting the choice-set considerably. The situation is particularly acute in mathematics and physics (OECD, 2004a). Principals in upper-secondary schools say that the subject areas for which they have the greatest difficulty hiring teachers are mathematics, computer sciences, and the sciences. The situation appears to be less problematic in the social sciences (OECD, 2004a).

The teaching force in Switzerland is mainly female (just over 72% of all teachers in public schools were female in 1999 at the primary level). The proportions change as one moves to higher levels: only 45% of teachers are female at the lower-secondary level; around 32% are female at the upper-secondary level (OECD, 2004a).

A study by Henneberger and Souza-Poza in 2002 put the turnover rate for the teaching sector as a whole at approximately eight percent. This figure was below the average of just over 10% for all sectors in the economy. There was some variation across cantons, where the range was 5% to 11%. Because the teaching force is not particularly old, retirement does not explain turnover in any significant way (OECD, 2004a).

Teacher recruitment, hiring, and education

The task of recruiting, selecting, and appointing teaching staff in Switzerland is the responsibility of the cantonal and communal authorities together with the commune's school committees and the schools' management/principals. The degree of involvement of each of these stakeholders varies by canton. Generally, the school principal/management plays the major role in recruitment and selection, even when the formal responsibility lies with the school committees. This trend is especially true of upper-secondary schools and schools in the French-speaking part of the country. No standard procedure is followed during recruitment and hiring. In many cases, teachers have the right to suggest who should be recruited. Sometimes they participate in the selection process in their capacity as members of the school committee. The selection procedure is, however, thorough. It typically involves consideration of applicants' files and "portfolios," a guided visit of the school, interviews, and sometimes a probationary

23 Unless stated otherwise, information in this section is drawn from http://www.about.ch/education/index.html.

lesson. Applicants for primary and lower-secondary schools submit their applications directly to the communal school committee, while those wanting to teach at the upper-secondary level apply directly to the schools they are interested in (OECD, 2004a).

Cantons have been experimenting with different ways of increasing recruitment and ensuring the necessary number of teachers. For instance, 23 cantons are encouraging part-time teachers to increase their number of contact hours, 16 cantons are encouraging leavers to return to the profession and offering in-service professional development courses for teachers wishing to change their teaching level, and 10 cantons are increasing the number of places in initial teacher education programs. These endeavors are not, however, targeted specifically at mathematics and science teachers, who are in particularly short supply. Moreover, there are currently no premiums or bonuses for mathematics science teachers, although there is the possibility of introducing salaries as a function of the subject taught to reflect labor market shortages in certain cantons such as St. Gallen (OECD, 2004a).

All school teachers in Switzerland must complete education at the tertiary level (OECD, 2004a). Training routes vary depending on the level and type of program for which a candidate is preparing.[24] The initial preparation of teachers for primary and lower-secondary schools takes place in a single location, typically *haute écoles pédagogiques* (HEP) or *pädagogische hochschulen* (PH), which are institutes attached to universities or are universities themselves. The initial education of teachers at the upper-secondary/gymnasium level combines a general education at a university or federal institute of technology, leading to an academic degree in a given discipline, with pedagogical and didactic preparation in a HEP or PH, in faculties of educational sciences of some universities, or in tertiary-level institutes of teacher education (OECD, 2004a).

Although the teacher education programs offered by the 15 different HEPs and PHs vary considerably in design, they generally offer courses covering a set of disciplines and the educational sciences (e.g., pedagogy, didactics, and educational psychology) as well as a field-level component (practicum) carried out in schools. The latter must take up 20% to 30% of the total study time (OECD, 2004a). Today, teacher education programs place greater emphasis than previously not only on instruction that is interdisciplinary and involves open workshops and group- and project-based activity, but also on applied educational research.

Pre-service education for teachers intending to work in primary schools lasts at least three years. For those wanting to teach in the lower-secondary schools, the period of study covers four and a half years. *Gymnasium* (high school) teachers' pre-service education covers five or (more usually) six years. As of 2001, 99% of teachers at the primary level had the appropriate teaching certificate; the figure was 90% for teachers at the lower- and upper-secondary levels. There is considerable variation in the percentages, however, from canton to canton.[25] In Lucerne, for instance, in the early 2000s, the percentage of teachers at the lower-secondary level was 30% (OECD, 2004a).

24 The typical structure of education in Switzerland consists of five to six years of primary school, three to four years of lower-secondary school, and three to four years of upper-secondary (*gymnasium*) schools. Primary schooling and lower-secondary schooling are compulsory in Switzerland.

25 The Swiss political structure consists of three different levels: the confederation, the cantons, and the communes. The confederation is at the top of the hierarchy, the cantons in between, and the communes at the bottom.

Teacher salaries

Teachers in Switzerland generally are paid according to a salary scale that corresponds to the school level in which they teach and their initial education. Advancement for an individual teacher occurs within their initial salary scale and typically depends only on years of service. The formal employer of teachers in Switzerland is the canton or the commune (OECD, 2004a). Terms of employment, including the salary scale, is therefore determined by one of the two. Also, teachers are not offered a lifetime contract, a practice that guards against teachers becoming complacent and motivates them to continuously improve their performance. In general, teachers' salaries for a particular set of characteristics are set uniformly within a canton, but there is considerable variation across cantons to reflect differences in number of lessons taught and costs of living (OECD, 2004a).

Teachers' working time is defined in terms of teaching hours. These vary by canton, from 1,900 hours to 2,000 hours per year. On average, the hours are broken down as follows: classroom-based teaching (50%), preparation (23%), planning and evaluation (11%), administration and counseling (8%), and continuing education and joint activities (8%) (OECD, 2004a).

In the early 2000s, primary school teachers earned less than teachers at higher levels, but at $US35,059 per annum, their starting salary was nevertheless the second highest among the commensurate salaries of all OECD countries. The starting salaries of secondary teachers and upper-secondary teachers, which were $US41,358 and $US49,484, respectively, ranked the highest among the starting salaries for teachers of all OECD countries except Luxembourg (OECD, 2004a). This situation had not changed by 2007 (OECD, 2007).

Some cantons, such as Zürich and St. Gallen, have moved away from seniority-based pay to pay based on performance. This development is a recent one. In both cantons, salary increments are provided over a period of years rather than on the basis of annual reviews of work. In Zürich, the assessment includes classroom observation, an interview with the teacher being evaluated, and a report describing his or her pedagogical approach. In St. Gallen, the assessment focuses on three skill areas: organization and delivery of lessons; interactions with students, parents, and teachers; and participation in in-service professional development. Neither place emphasizes subject-specific merit pay.

An analysis of salaries conducted early this decade and taking into account hours of work, age, professional development, experience, geographic region, and gender, showed teachers' salaries comparing favorably with salaries in other professions (OECD, 2004a). Teachers' salaries in comparison to GDP per capita were high. At the lower-secondary level, for instance, a comparison of the salaries of teachers who had been teaching for 15 years with GDP per capita placed Switzerland in third place among 29 OECD countries. Pay in certain sectors, such as finance and insurance, were higher, but in other sectors, such as wholesale and the retail trade, hospitality, health, and social work, pay levels were lower (OECD, 2004b). No differences in salary by gender were evident. However, because there are more male teachers than female teachers in the lower-secondary and upper-secondary levels of the school system, and given that the pay is higher in these sectors of the education system than in the primary sector, the average male teacher is likely to earn more than his female counterpart.

Tables 43 and 44 and Figures 58 to 61 show the median salaries of Swiss teachers compared to the salaries of Swiss mathematics-oriented professionals for two years, 1996 and 2004.

Table 43: Switzerland, Median Gross Monthly Earnings, by Gender, Age, and Occupation, 1996

	Males				Females			
Age	*Accounting & Personnel*	*Research & Development*	*Analysis, Programming, Operating*	*Teaching Activities*	*Accounting & Personnel*	*Research & Development*	*Analysis, Programming, Operating*	*Teaching Activities*
20–29	4,861	5,404	5,566	5,036	4,333	4,756	4,639	4,623
30–39	7,000	7,400	7,235	6,825	5,417	6,271	6,452	6,067
40–49	8,125	8,837	8,435	7,576	5,781	6,913	6,240	6,457
50–65	8,667	9,149	8,742	9,140	5,988	7,863	6,322	7,610

Source: Swiss Federal Statistical Office, Swiss Earnings Structure Survey, 1996, section on wages and working conditions.

Table 44: Switzerland, Median Gross Monthly Earnings, by Gender, Age, and Occupation, 2004

	Males				Females			
Age	*Accounting & Personnel*	*Research & Development*	*Analysis, Programming, Operating*	*Teaching Activities*	*Accounting & Personnel*	*Research & Development*	*Analysis, Programming, Operating*	*Teaching Activities*
< 20	3,858				3,735			
20–29	5,506	6,169	6,046	5,379	4,979	5,579	5,631	5,100
30–39	8,250	7,975	8,239	6,770	6,423	7,385	7,552	6,386
40–49	9,208	9,188	9,499	7,887	6,500	8,333	8,155	7,078
50–65	9,376	9,673	9,768	8,629	6,592	8,030	7,677	7,648
> 65	8,055			6,067	6,328			6,788

Source: Swiss Federal Statistical Office, Swiss Earnings Structure Survey, 2004, section on wages and working conditions.

Figure 58: Switzerland, Median Gross Monthly Earnings of Males, by Age and Occupation, 1996

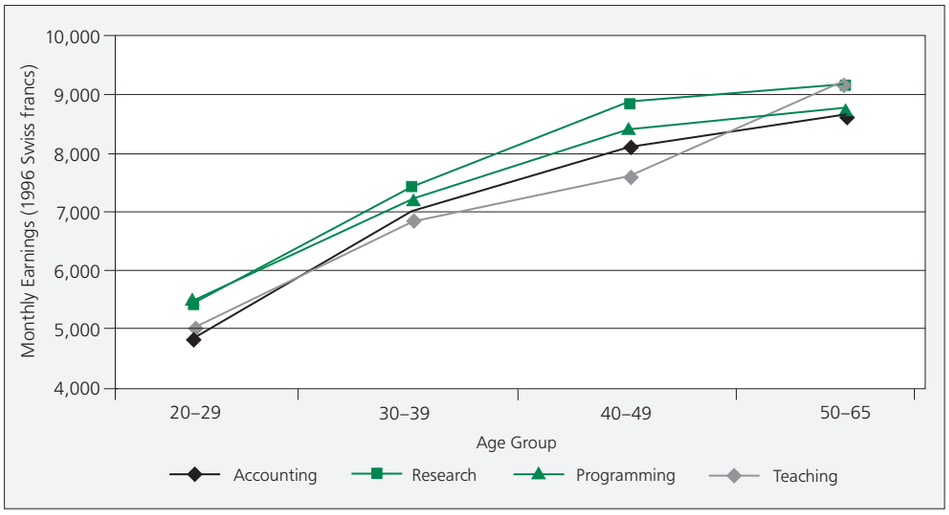


Figure 59: Switzerland, Median Gross Monthly Earnings of Females, by Age and Occupation, 1996

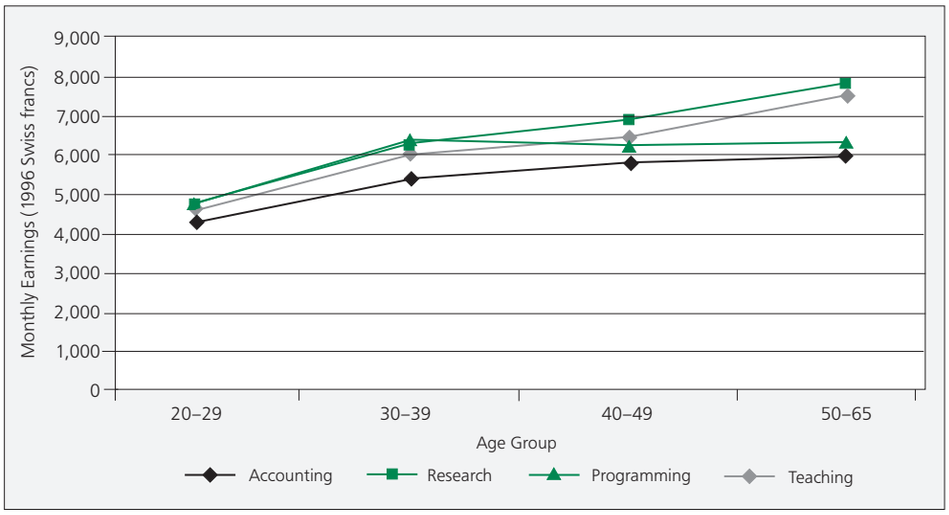


Figure 60: Switzerland, Median Gross Monthly Earnings of Males, by Age and Occupation, 2004

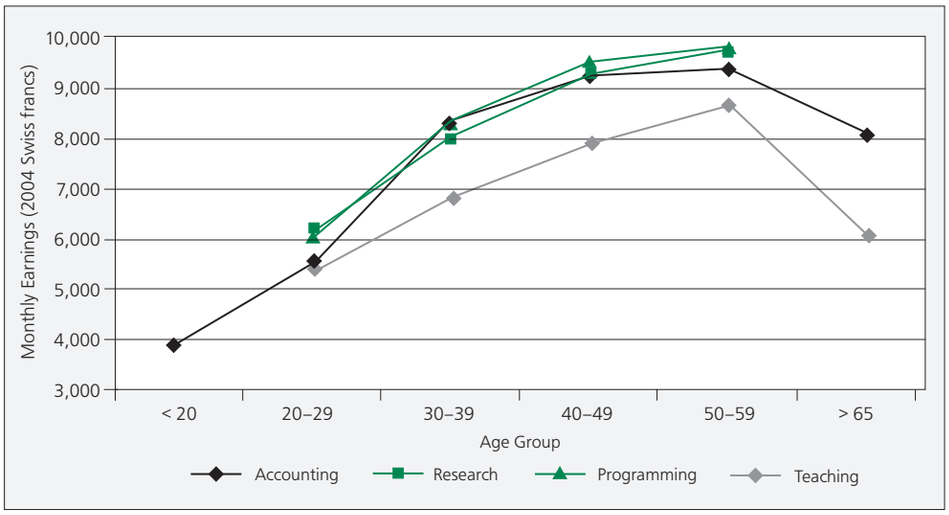
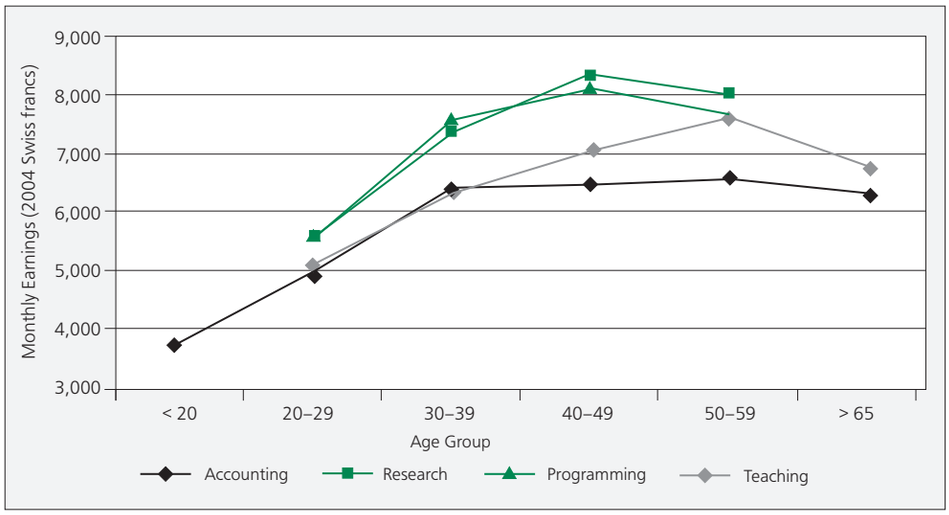


Figure 61: Switzerland, Median Gross Monthly Earnings of Females, by Age and Occupation, 2004



In 1996, Swiss teachers, both male and female, earned salaries that were as good as or better than the salaries of mathematics-oriented professionals. Male teachers did somewhat less well than female teachers, but were still competitive, salary-wise, with the other professions. By 2004, this pattern had changed. Male and female teachers had both lost ground, particularly with reference to research and analysis/programming professionals (Figures 60 and 61). This information suggests that recruiting high-quality graduates into mathematics teaching is more difficult now than it was in the 1990s. Another point of note is that changes in the Swiss salary structure were similar to the changes that occurred in Germany across the years under consideration, and probably came from the same source: declines in public-sector spending relative to economic expansion, which naturally affected teacher salaries.

References

Organisation for Economic Co-operation and Development (OECD). (2004a). A*ttracting, developing, and retaining effective teachers. Country note: Switzerland*. Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2004b). *Education at a glance: Education indicators 2004*. Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2007). *Education at a glance: Education indicators 2007*. Paris: Author.

Thailand

Background

In the past few decades, Thailand has shifted from an agrarian to a predominantly industrial and service economy, with about 60% of its labor force currently working in the non-agricultural sector. The country's relatively strong economic performance has been accompanied by a rapid increase in primary and secondary school enrollments.[26] The Thai government stresses the importance of enhancing educational quality rather than just quantity, in order to produce a more adaptable, innovative, and competitive labor force.[27]

By 2004/2005, only about 10% of Thailand's adult population possessed a tertiary or advanced degree; however, another 13% possessed a type B tertiary or upper-secondary-school degree (UNESCO, 2005). Recent studies show that Thai students are not performing satisfactorily in the fields of mathematics, sciences, and foreign languages, and that the country needs to improve its science and technology education (Office of the Education Council, 2004). Teachers are seen as a key component in promoting education of a higher quality in Thailand, especially in the areas of science and mathematics.

Composition of the teacher labor force

In 2001, Thailand employed 254,435 primary, 39,870 lower-secondary, and 85,569 upper-secondary teachers with various skill levels (Office of Commercial Services, 2002). The number of primary school teachers increased by 0.6% between 2000 and 2004, but the number of secondary school teachers decreased by just under 4% over the same period (UNESCO, 2005). The teacher–student ratio has also decreased in recent years, stabilizing at a 1:19 ratio for primary schools and a 1:21 ratio for general secondary schools in 2002 and 2003 (Office of the Education Council, 2004). In 2004, just under 58.5% of primary school teachers and 51.5% of secondary school teachers were female, a percentage somewhat lower than that of most other countries (UNESCO, 2004).

Primary education is characterized by a huge oversupply of teachers, with only one in 10 prospective teachers being able to find a job in 2002 (Office of Commercial Services, 2002). A study by the Teacher Education Reform Office in 1998 predicted an excess of 120,000 trained teachers by 2002. Another study (Fry, 1999) found that post-secondary institutions had trained 20 to 25 times more prospective teachers than needed. Despite this situation, there was a significant shortage in qualified science, mathematics, and foreign language teachers in secondary schools.

Policies since the turn of the century have recommended early retirement programs in order to manage the large number of aging and experienced teachers established in traditional rote-learning methods. A strong, negative relationship between age and qualifications supported this recommendation (Fry, 1999). In 1999, the average teacher was 45 years old, had 22 years of teaching experience, and possessed either a diploma

26 By 1998, nearly 91% of the relevant age cohort was enrolled in primary schools and just over 72% in secondary schools. By 2004, there were 5,539,908 primary school students, 2,732,862 lower-secondary school students, and 2,126,938 upper-secondary school students (Office of the Education Council, 2004).

27 For example, the 1997 Constitution of the Kingdom of Thailand ratified 12 years of free basic education for every child, and also acknowledged the importance of decentralized education management. The 1999 National Education Act that followed was further amended in 2002, and it led to a more concrete and comprehensive reform that included prospective changes concerning teacher and educational personnel.

or a Bachelor's degree, generally without teacher education or formal qualifications in mathematics, science, and foreign-language subjects. Fry also found that students entering teacher education had generally low examination scores, thus underscoring concerns about teacher quality.

Teacher education

In the 1990s, Thai teachers generally obtained either a two-year diploma or a Bachelor's degree from a variety of teachers' colleges and universities. Recently, the government emphasized changing teachers' colleges offering two-year degrees into full universities and upgrading overall teacher requirements (Fry, 1999; Office of the Education Council, 2004). The Ministry of Education created a new five-year Bachelor's degree curriculum for prospective teachers that includes four years of coursework and a one-year teaching practicum. In 2002 and 2003, about 36 *rajabhat* (teaching) universities (RUs) began developing new content for Bachelor's and Master's degrees in education administration and teaching.

A number of policies and programs have further attempted to upgrade the overall quality of the teacher labor force. For example, the government has offered scholarships and job security guarantees in order to attract more qualified students into teacher education programs. Between 2004 and 2006, 7,500 five-year scholarships were provided for qualified students entering various levels of basic education (Office of the Education Council, 2004). Also, in-service teacher education initiatives sponsored by a number of institutions have sought to move away from traditional pedagogical practices. Acting teachers with two-year diplomas can take an additional two years of courses, or 66 credits; it was hoped that, by 2007, all diploma in-service teachers would have Bachelor's degrees (Office of the Education Council, 2004). Because the number of teachers possessing Master's degrees is still fairly small, the steps taken to encourage teachers to acquire postgraduate degrees have been modest (Office of the Education Council, 2004).

The Teachers' Council of Thailand recently established professional standards requiring teachers to have either a Bachelor's degree in education or a Bachelor's in another subject plus 24 credits in education, along with a one-year teaching practicum. These teachers also receive instruction manuals prepared at the national level to help them use student-centered pedagogical approaches and to learn the knowledge and methods needed to teach eight different subject areas. The standards and manuals are a reaction to the fact that many of the secondary school teachers who earned their jobs at the time of the rapid expansion in basic-education enrollments possessed tertiary degrees but had little or no teacher education.

A few small national programs are active in offering special support for teachers qualified in mathematics, science, and computing. One program, for instance, has offered close to 3,000 scholarships for prospective science and mathematics teachers. The Institute for the Promotion of the Teaching of Science and Technology (IPST) in Bangkok has also offered in-service teacher education in mathematics and science, and the "master teachers" they produce are supposed to help other teachers in different localities improve their knowledge and practice (Office of Commercial Services, 2002).

Teacher recruitment and salary structures

The Ministry of Education not only approves and enforces general policies and guidelines for all basic-education institutions in Thailand but also devolves authority concerning academic, budgetary, and human resource allocation decisions to local schools. Each local school has a 7- to 15-member board that works with administrators to make decisions concerning recruitment, hiring, training, and the like. The school boards can also determine allocation of certain local resources for education and conduct quality assessment and assurance activities (Office of the Education Council, 2004).

Although the central government stresses the importance of revenue for education being collected at the local level, it still provides the major financial support for basic education throughout the country. The government covers the capital and operating costs of public schools, as well as the operating costs of private schools (Office of the Education Council, 2004). Teacher salaries are thus provided according to a uniform national standard that is the same across primary and secondary education levels, and the same for both genders.[28] Salaries are generally higher for public school teachers, but private schools can charge "additional fees for improving the quality of education" within limits set by the government-based Office of the Education Council.

The national salary structure generally does not reward teacher performance or distinguish between different academic subject areas. This situation has led to various imbalances in teacher supply, even though local schools can elect to increase salaries above the national standard according to individual teacher performance, subject area needs, and the like (Fry, 1999). According to information contained in the UNESCO Institute for Statistics database, primary school teachers in Thailand can receive additional bonuses and benefits for teaching extra hours, holding a higher educational qualification at entry, and gaining higher scores on the qualification examination. However, salaries tend to be based on experience rather than on age, and they are not aligned with completion of professional development programs, performance, and/or academic subject area.[29]

The teacher salary structure can be mapped onto the national Civil Service Commission salary structure, which has separate "scales," each with various levels (Office of Commercial Services, 2002). Achieving higher salary levels depends on years of experience as well as on receiving a satisfactory mark on the annual confidential evaluation report (Office of Commercial Services, 2002). Teachers can rarely jump a scale, except when they complete special research projects or written requirements. Because it is much easier for individuals in other government sectors than it is for teachers to jump to higher scales, teacher salaries are generally lower than the salaries of other government employees. Teachers also have fewer opportunities than many other professionals for quick promotion, another factor limiting the likelihood of high-quality secondary students wanting to enter teaching (Office of Commercial Services, 2002). A 1998 survey of more than 1,000 graduates found that very few students pursued mathematics and science teacher opportunities, and that low salaries were the greatest deterrent to entering teaching (Fry, 1999).

28 Public teacher annual salaries for all basic-education levels in 1999 (in equivalent US dollars converted using PPPs) were $5,781 for a new teacher, $14,208 for a teacher with 15 years of experience, and $27,098 for a teacher at the top of the salary structure (UNESCO & OECD, 2005). In 2003, the corresponding numbers were $6,048, $14,862, and $28,345, respectively (UNESCO, 2005). About 37 years are needed for teachers to move from minimum to maximum salary at all levels of basic education.

29 In 2001, the base monthly salary level for teachers with a Bachelor's degree was 6,360 baht. For a teacher with a Master's degree, the base monthly salary was 7,780 baht (Office of Commercial Services, 2002).

Finally, the total number of hours teachers spend teaching varies according to education level. In 2003, all basic-education teachers taught an average of 187 days, but primary school teachers taught for 900 hours, lower-secondary school teachers for 1,100 hours, and upper-secondary school teachers for 1,200 hours.

We estimated the salaries detailed in Tables 45 and 46 with reference to labor force surveys of 1996 and 2005. We made these estimates by age group. Although males and females receive the same pay relative to equal experience and education, experience levels may vary somewhat between males and females of the same age. Our earnings estimates included bonuses paid on top of the base salary. The tables show that the mean monthly earnings for female teachers in 1996 were very similar to those of female scientists and non-scientists. However, by 2005, this situation had changed in favor of non-teaching professionals. For males, teacher salaries were already below those of competing professions in 1996, and the gap grew over the next nine years, a development that was unsurprising, given the large oversupply of teachers in Thailand during these years. Nonetheless, the numbers also suggest that schools would have experienced increasing difficulty over these years recruiting mathematics teachers and science teachers with the level of knowledge needed to be good teachers of these subjects.

Table 45: Thailand, Mean Monthly Earnings, by Occupation, Age, and Gender, 1996 (current US dollars)

	Scientists		Teachers		Non-Scientists	
Age	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*
20–24	302	310	227	218	233	266
25–29	356	433	272	263	297	335
30–34	372	439	333	352	350	376
35–44	455	648	478	501	484	538
45–54	840	887	615	649	641	753
55–64	629	1,432	689	757	698	851

Source: Statistical Information Service and Dissemination Group, Thai Labor Force Survey, 1996.

Table 46: Thailand, Mean Monthly Earnings, by Occupation, Age, and Gender, 2005 (current US dollars)

	Scientists		Teachers		Non-Scientists	
Age	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*
20–24	436	395	192	167	208	217
25–29	293	378	183	210	240	282
30–34	401	472	227	254	299	376
35–44	516	622	373	418	413	483
45–54	705	794	559	549	567	643
55–64	903	1,059	675	629	740	840

Source: Statistical Information Service and Dissemination Group, Thai Labor Force Survey, 2005.

Figures 62 to 65 make the same point with reference to median earnings (including bonuses). Median earnings reflect earning differences at the "true" middle of the income distribution. These earnings over a lifetime confirm the finding that earning differences between mathematics-oriented professionals (scientists) and teachers increased between 1996 and 2005, making it more difficult in 2005 to recruit persons skilled and knowledgeable in mathematics and science into teaching. The fact that teacher salaries fell from 1996 to 2005, whereas scientists' salaries fell less severely and, for females, tended to increase, suggests that the oversupply of teachers had a severe dampening effect on teacher income in Thailand.

It is unusual to see declining incomes for university graduates in any country during this period, but in 1997, the Southeast Asian financial crisis produced a sharp recession in Thailand that drove down most wages over the next year. Our data make clear that teacher salaries and non-scientist salaries did not recover by 2005, and that whereas scientists' salaries also did not recover, female scientists, much more than female non-scientists, did some catching up salary-wise with male scientists. However, a fairly large gap in earnings between the two types of occupations for both males and females was very much in evidence.

Figure 62: Thailand, Median Monthly Earnings of Males with Bachelor's Degree, by Age and Occupation, 1996

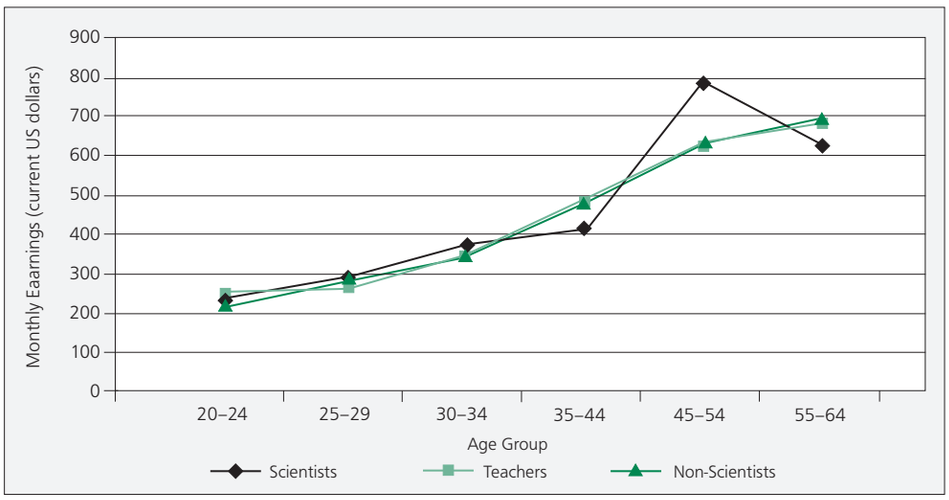


Figure 63: Thailand, Median Monthly Earnings of Females with Bachelor's Degree, by Age and Occupation, 1996

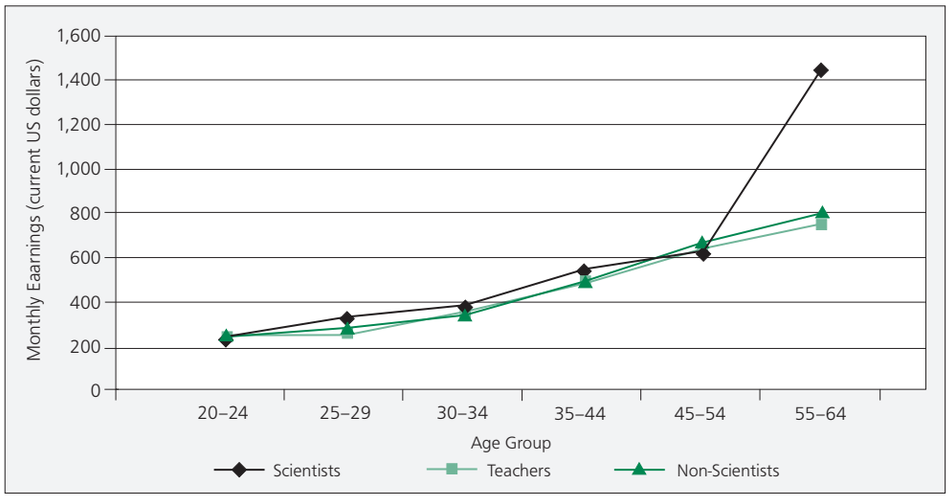


Figure 64: Thailand, Median Monthly Earnings of Males with Bachelor's Degree, by Age and Occupation, 2005

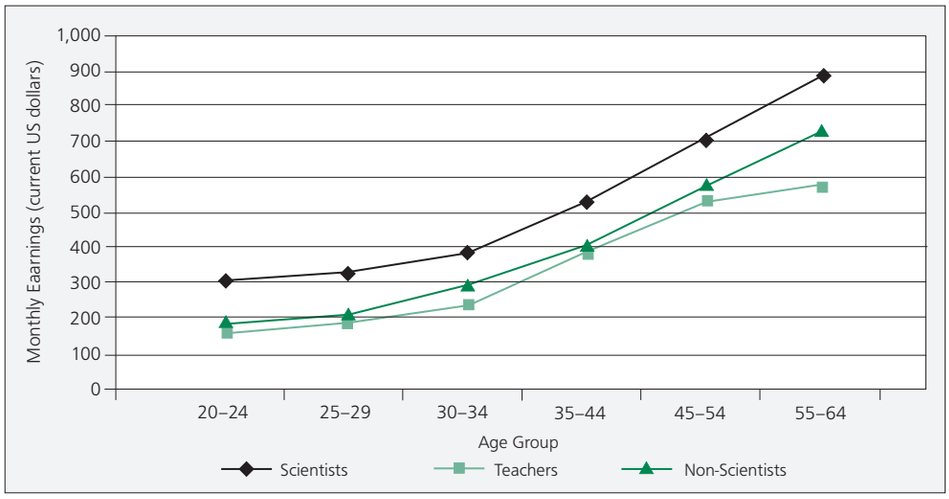
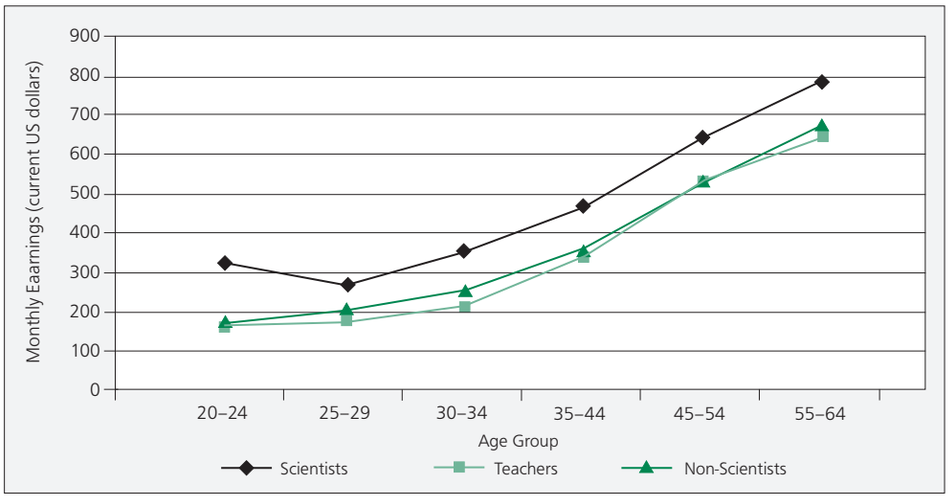


Figure 65: Thailand, Median Monthly Earnings of Females with Bachelor's Degree, by Age and Occupation, 2005



References

Fry, G. (1999). *Teaching personnel strategy in Thailand: A review and recommendation*s (report prepared for UNESCO-Bangkok). Bangkok: UNESCO.

Office of Commercial Services. (2002). *Teacher development for quality learning: The Thailand Education Reform Project.* Brisbane, QLD: Queensland University of Technology.

Office of the Education Council, Ministry of Education. (2004). *Education in Thailand.* Bangkok: Amarin Printing and Publishing.

UNESCO. (2004). *Teachers and educational quality: Monitoring global needs for 2015.* Paris: Author.

UNESCO & Organisation for Economic Co-operation and Development (OECD). (2005). *Education trends in perspective: Analysis of the world education indicator*s. Paris: Author.

United Kingdom

Background

Although the Labour Force Survey used for this analysis encompasses all four countries of the United Kingdom, educational policies differ in each one. In Scotland, educational policy is distinct from that of the rest of the United Kingdom. In Wales, government services recently devolved to local authorities, but Wales and England jointly govern teachers' pay and service conditions. Although Northern Ireland has its own department of education, London directs many of the country's executive and legislative decisions. In terms of population, England makes up just over 83.5% of the United Kingdom's population of nearly 60 million, followed by Scotland (almost 8.5%), Wales (just under 5%), and Northern Ireland (3%) (Ross & Hutchings, 2003).

Composition of the teacher labor force

According to statistics from the Department for Children, Schools, and Families, the number of public school teachers in England in 2007 was about 440,000. The corresponding numbers were 26,503 in Wales, 20,474 in Northern Ireland, and 48,870 in Scotland. Between 1997 and 2007, the number of teachers increased in each country; in England and Northern Ireland, growth of the teacher workforce actually outpaced growth of the student population. For example, the overall teacher–student ratio in 2007 in England was 1:17, down from 1:18.6 in 1997; the average class size in 2005 in the United Kingdom as a whole was about 25 (OECD, 2007). However, an aging trend among the United Kingdom's teaching force suggests the possibility of a teacher shortage over the next decade. Between 1992 and 2000, the percentage of lower-secondary teachers 50 years of age or older increased from 17% to 24% (OECD, 2004). In England, 45% of all current teachers are likely to retire by 2018, including 50% of all male teachers. Moreover, the number of new teachers and trainee teachers is generally not sufficient to replace the number of teachers on the verge of retirement. The school-age population is projected to fall until around 2018, after which it is likely to increase until 2025 (Ross & Hutchings, 2003).

Historically, England has experienced periodic teacher shortages, particularly in urban areas and within and near London, while Wales, Northern Ireland, and Scotland have had fewer problems with shortages of teachers. Nevertheless, by 2007, England had an overall teacher vacancy rate of only 0.6%, higher than the vacancy rates in Wales (0.4%) and Scotland (0.1%), but only one-half the rate in 2002. In England, the most difficult area to staff with teachers is inner London, which had a vacancy rate of just over four percent in 2001, just over three percent in 2002, but only a little more than one percent by 2007. Filling teaching vacancies continues to be a problem in areas surrounding London, as well as in England's southern and southeastern regions, where economic growth has led to relatively high wages in the private sector. To address the potential for shortages, policymakers in England introduced incentive programs to attract prospective teachers into teacher education programs and to recruit former teachers who have left the profession. In Scotland, initiatives to improve teaching conditions and workloads are part of measures to attract and retain new teachers (Ross & Hutchings, 2003). Anecdotal and other evidence suggest these measures are reducing vacancy rates.

The teaching profession in the United Kingdom is not only aging but also becoming increasingly feminized, as male teachers become increasingly older and few young males enter teaching. As in other European countries, the primary teacher labor force is more than 80% female. The secondary school teacher labor force is much less so, but it is still 60% female, higher than in countries such as Germany, and about the same as in France. As of 2003, 83% of English primary teachers and 55% of secondary teachers were female. If recruitment of male teachers continues at the same rate as during the past 20 years, the percentage of male teachers will drop to just over 40% by 2018. In Scotland, 93% of primary teachers and 53% of secondary teachers are female. In addition, 59% of male secondary teachers are 45 years of age or older and 77% are over 40 (Ross & Hutchings, 2003). Even so, the UK teacher labor force is younger than the teacher labor force in the rest of Europe and somewhat younger than the teaching cohort in the United States; 45% of United Kingdom primary teachers and 42% of secondary teachers are in their 20s and 30s.

Teacher education

Teachers in England and Wales must earn qualified teacher status (QTS), generally by completing an undergraduate or a postgraduate teacher education program. In Northern Ireland and Scotland, teachers must earn a recognized teaching qualification. Since the early 1990s, the proportion of future teachers pursuing undergraduate degrees in both primary and secondary fields decreased, while participation in postgraduate degree programs increased. In England, for example, the percentage of primary pre-service teachers pursuing undergraduate degrees decreased from 66% in 1992 to 45% in 2003, while the percentage of students in undergraduate secondary courses decreased from 24% to 8%. In addition, employment-based routes into teaching have become increasingly popular in England and Wales (Ross & Hutchings, 2003).

Teacher recruitment and hiring

Teachers in the United Kingdom are generally hired through a competitive process in which individual schools recruit and assign teachers. In Scotland, local authorities or individual schools in the independent (private) sector are responsible for recruiting teachers. Teacher shortages in particular subject areas are generally not a problem in Scotland and Northern Ireland. England and Wales, however, have developed several incentive programs to attract teachers to subject areas where teachers are in short supply. These include, in particular, mathematics, science, business, and technology. Potential teachers with backgrounds in these fields generally have attractive alternative opportunities in industry, a situation that makes teacher recruitment in these areas even more difficult. Teachers with these shortage backgrounds qualify for a number of programs. Among them are the Secondary Shortage Subject Scheme, which provides grants of up to £5,000 in England, a loan write-off program in England and Wales, a "Golden Hello" program in England that provides a grant to new teachers of up to £4,000, and a teaching grant for pre-service teachers of up to £6,000 in Wales (Ross & Hutchings, 2003). Financial incentives and programs of this kind are not available in Scotland.

Teacher salaries

In both England and Scotland, teachers earn similar salaries regardless of the level they teach. For example, a primary teacher in Scotland who has reached the top of the salary scale in terms of experience but with minimum teacher education earned $48,205 ($PPP) in 2005, identical to salaries earned by similar teachers in lower- and upper-secondary schools. In England, the corresponding salary was $43,835 (OECD, 2007). The difference between teachers at the top of the salary scale and those at the bottom is lower than the average ratio in OECD countries. While top-salary lower-secondary teachers in OECD countries earn on average 1.71 times the remuneration of the lowest-earning teachers, the ratio between top and bottom is 1.55 times in England and 1.46 times in Scotland (OECD, 2004).

In terms of annual salaries, secondary teachers in Scotland with 15 years of experience and minimum teacher education ranked fifth among OECD countries in 2005. Their annual salary at the time was $48,205, again calculated according to PPP. Teachers in England earned $48,435, placing them eighth among OECD countries. In terms of the ratio of salaries to GDP per capita, teachers in Scotland earn 1.47 times GDP per capita while teachers in England earn 1.33 times GDP per capita, placing both countries above the OECD mean of 1.30 times GDP per capita. In PPP terms, beginning teachers in Scotland with minimum teacher education earned more ($30,213) than new teachers in England ($29,992) in 2005. Teachers in both countries earned slightly more than the mean of beginning teachers in OECD countries, which was $29,772 in 2005 (OECD, 2007).

Between 1996 and 2002, the numerical value of salaries for beginning teachers increased by more than the mid-career and the top-of-the-scale salaries in both England and Scotland, indicating the desire of these countries to attract younger teachers to the profession. For example, in Scotland, salaries for beginning teachers increased by 21% during this period, while salaries for teachers at the top of the salary scale increased by only 6% (OECD, 2004). England continued this policy direction between 2002 and 2005, increasing starting salaries by 18% and top-of-the-scale salaries by only 11%. Scotland reversed its salary policy direction, raising high-end salaries by 19% and starting salaries by only 11% (OECD, 2007).

Teachers' comparative salaries

The starting salary for teachers in England and Wales in 2003 was £17,595, lower than the average graduate's starting salary of £19,714. In Scotland, the starting salary for a teacher who had completed his or her probation year was £21,588. Teachers' starting salaries were higher than those of other public-sector workers, such as social workers, but lower than those of police officers, who earned on average £19,842. There is also evidence that teachers' salaries have fallen behind the salaries of other college graduates over time. Estimates based on data from the Labour Force Survey indicate that while teachers under 25 years of age earn just below the average salary of all graduates, teachers 25 to 29 years of age earn 86% of the average graduate salary and teachers 30 to 39 years of age earn 80% of the average salary of all graduates. However, a revision of teachers' pay scales in England, Wales, and Northern Ireland in 2002 has allowed teachers to reach the top of the pay scale in five years, after which they can move on to a higher scale. This ability to increase salary rapidly within the first five years compares favorably with the situation for workers in other public-sector jobs, who generally cannot increase their salaries as rapidly (Ross & Hutchings, 2003).

We compared teachers' salaries in the United Kingdom with those of scientists and engineers, taking into account gender and degree level. Our findings indicate that United Kingdom teachers are remarkably well paid relative to other professionals. Table 47 shows that weekly earnings for secondary teachers with Bachelor's degrees are higher than the salaries of both science and engineering professionals except for older male workers (the employment survey did not have observations for female scientists and engineers in higher age groups). Secondary teachers with higher degrees also fare well. Again, older scientists and engineers (both male and female) tend to earn more than secondary teachers, but generally United Kingdom teachers' earnings are highly competitive with those in mathematics-intensive occupations in industry. Nevertheless, female science professionals gain considerably more than do secondary school teachers from securing a higher degree. Part of this larger gain is probably due to more science professionals gaining doctorates, an attainment that is rare among teachers. The average educational attainment for individuals in the two occupations may thus not be totally comparable at the secondary school level.

Does the same pattern hold for primary school teachers? At the Bachelor's degree level, it does. In 1999, salaries across the professions were very similar, even at the higher degree level (Tables 47 and 48). Both male and female primary/nursery school teachers (the occupational code in the household survey includes primary and nursery school teachers) were earning about the same weekly earnings as secondary school teachers. By 2005, however, at the higher degree level, primary school teachers were earning considerably less than secondary school teachers, and (correspondingly) than scientists and engineers. Another observation is that between 1999 and 2005, salaries for teachers rose relative to the salaries of scientists and engineers; this was especially true for secondary school teachers.

Table 47: United Kingdom, Median Weekly Earnings, by Gender, Degree Held, Age, and Occupation, 1999 (current pounds)

	Males with Bachelor's Detgree				Females with Bachelor's Degree			
Age	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*
20–24	279			317	322	304	288	308
25–29	483	417	373	500	481	308	346	423
30–34		496	346	471	490	413	431	531
35–44	615	485	481	577	337	519	423	1,523
45–54	558	538	577	606	531	474	462	529
55–64		760		317	610	442		
	Males with Higher Degree				Females with Higher Degree			
Age	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*
20–24		298		425		282	321	
25–29	335	323	288	442	501	340	323	501
30–34	410	473	475	654	442	458	471	442
35–44	577	526	538	519	471	485	427	471
45–54	865	558	450	615	506	485	510	506
55–64	769	457		731		442	631	

Source: United Kingdom (UK) Quarterly Labour Force Survey #4012, March–May, 1999. Retrieved August 18, 2009, from http://www.data-archive.ac.uk/findingData/lfsTitles.asp.

Table 48: United Kingdom, Median Weekly Earnings, by Gender, Degree Held, Age, and Occupation, 2005 (current pounds)

	Males with Bachelor's Degree				Females with Bachelor's Degree			
Age	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*
20–24		417	462	308	244	346	381	
25–29	481	536*	500	500	427	430	445	438
30–34	490	654	654	558	477	692	615	369
35–44	519	635	738	615	519	654	558	558
45–54	808	577	808	734		673	635	
55–64		417	442	654		654	853	
	Males with Higher Degree				Females with Higher Degree			
Age	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*	*Science Profs*	*Secondary Teachers*	*Primary Teachers*	*Engineering Profs*
20–24	404			288	375	385	356	
25–29	394	481	392	615	442	423	519	485
30–34	587	692	485	615	529	673	542	635
35–44	577	731	565	750	638	673	592	
45–54	900	673	615	692	712	669	577	
55–64		692	808	555	577	577	756	

Note: *Interpolated.

Source: UK Quarterly Labour Force Survey #5211, March–May, 2005. Retrieved August 18, 2009, from http://www.data-archive.ac.uk/findingData/lfsTitles.asp.

Figures 66 to 69 make the same comparisons in terms of hourly wages (we left out primary school teachers so that the graphs would be easier to read). Again, the results show the United Kingdom secondary teachers receiving wages higher than those of competing professionals. Except for male engineering professionals with higher degrees, secondary teachers in 2005 were generally earning higher hourly wages than scientists and engineers were earning. This pattern was particularly evident for females.

Figure 66: United Kingdom, Median Hourly Earnings of Males with Bachelor's Degree, by Age and Occupation, 2005

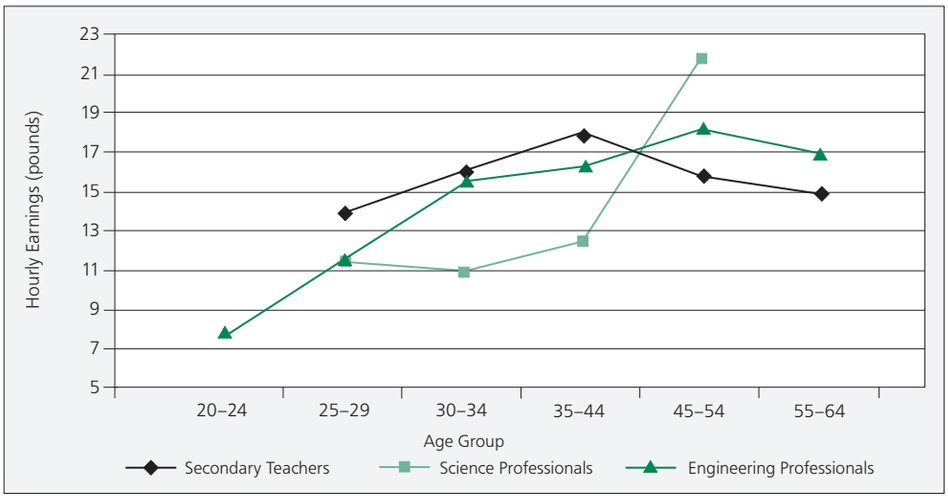


Figure 67: United Kingdom, Median Hourly Earnings of Females with Bachelor's Degree, by Age and Occupation, 2005

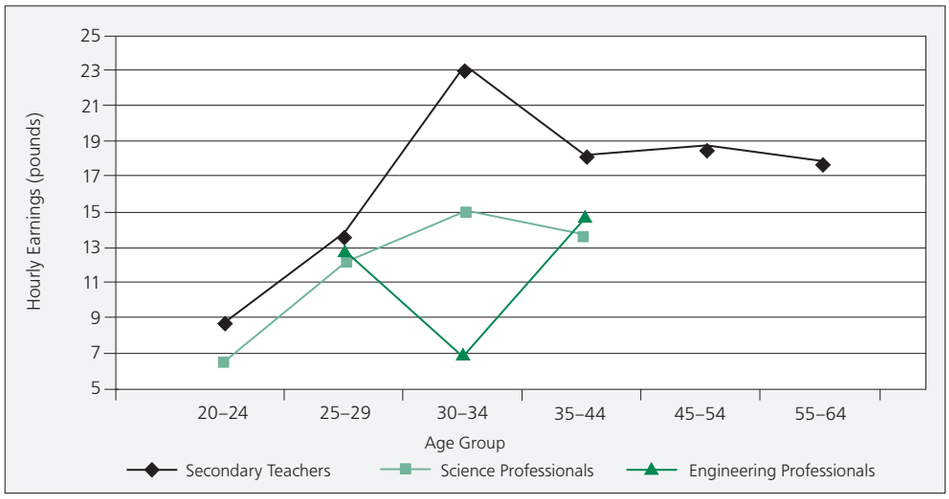


Figure 68: United Kingdom, Median Hourly Earnings of Males with Higher Degree, by Age and Occupation, 2005

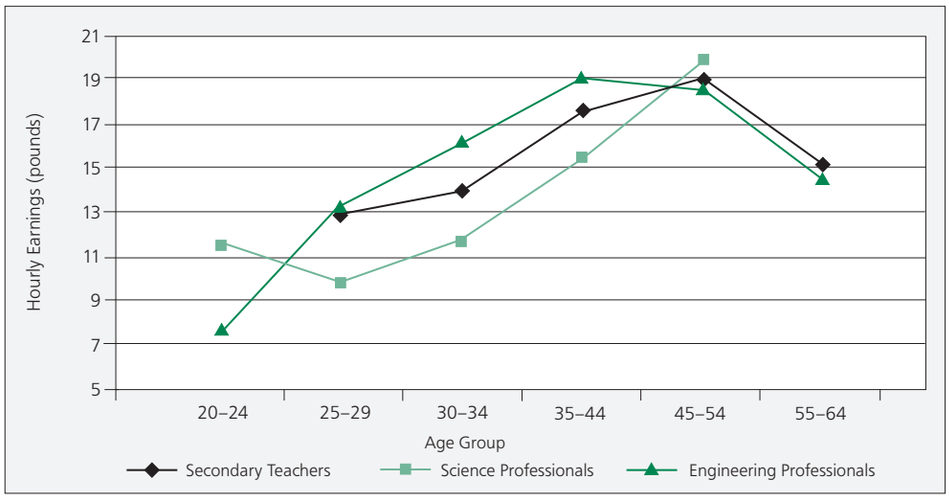
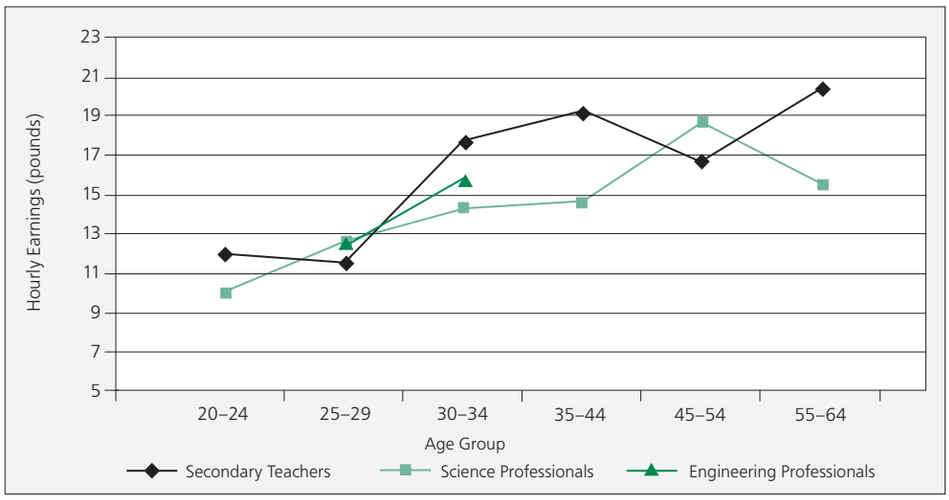


Figure 69: United Kingdom, Median Hourly Earnings of Females with Higher Degree, by Age and Occupation, 2005



The United Kingdom case is interesting not only because teachers are paid such high relative salaries but also because the United Kingdom's income distribution, while moderately equal, is not nearly as equal as that of Korea or Chinese Taipei. Nonetheless, given the salary structure in the United Kingdom, we would expect little difficulty in recruiting individuals with high mathematics skills into teaching. Thus, the costs of improving mathematics education in the United Kingdom should be fairly low. In fact, although students in the United Kingdom did not excel in mathematics on TIMSS 1999 or 2003, they gained relatively high scores on the TIMSS 1995 and PISA 2000 tests.[30]

References

Organisation for Economic Co-operation and Development (OECD). (2004). *Education at a glance: Education indicators 2004*. Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2007). *Education at a glance: Education indicators 2007*. Paris: Author.

Ross, A., & Hutchings, M. (2003). *Attracting, developing, and retaining effective teachers in the United Kingdom of Great Britain and Northern Ireland: OECD country background report*. London: Institute for Policy Studies in Education, London Metropolitan University.

30 The United Kingdom participated in PISA 2003, but the response rate was too low to ensure comparability, so results were not presented for most indicators.

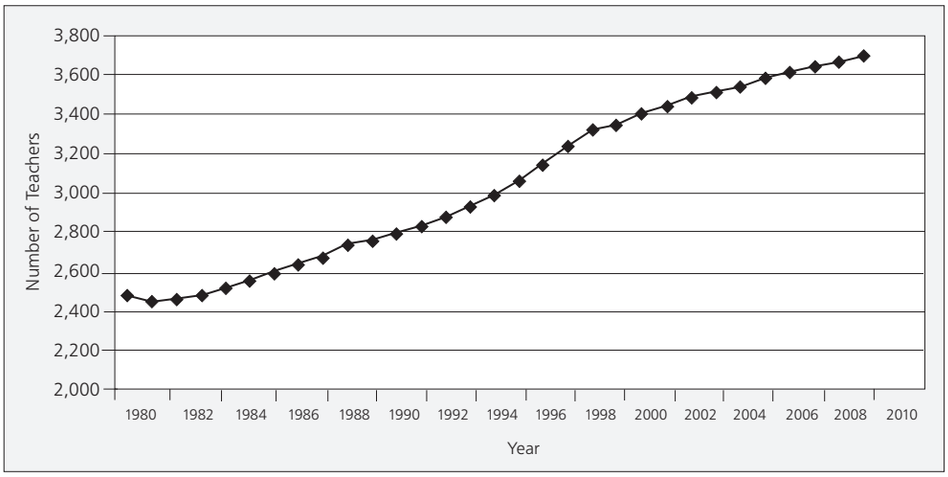
United States

Composition of the teacher labor force

The teaching force in elementary and secondary schools (public plus private) has grown steadily in the United States, from 2.3 million teachers in 1970 to 2.5 million in 1980, and from 2.7 million in 1990 through to 3.3 million in 2000, and on to 3.5 million in 2005 (National Center for Educational Statistics (NCES), 2004, Table 4). Figure 70 shows this trend. About 40% of the total K–12 teaching force in the 1990s was in secondary education. The proportion of teachers in private schools increased slightly in this period, from 10% to 11%.

The number of teachers has increased more rapidly than the number of students in schools: the student–teacher ratio declined from just under 22.5 students for every teacher in 1970 to just over 18.5 students per teacher in 1980, just under 17 per teacher in 1990, 16 in 2000, and 15.5 in 2005. This downwards trend is expected to continue in the coming years (NCES, 2004, Table 64). In the 10-year period encompassing 1970 to 1980, the drop in the student–teacher ratio exceeded the drop in ratio in the 25 years following 1980, even though the increase in the number of teachers was smaller, proportionately, than in the period 1980 to 2005.

Figure 70: United States, Public and Private School Teachers, 1980 to 2010 (Projected)



Source: NCES (2004, Table 4).

Teacher education and recruitment

Teacher education, recruitment, and pay are highly decentralized in the United States. Each state sets its own requirements for teacher certification, although some states have provisions for "alternative" or "emergency" certification schemes that allow people who have not met all state requirements to teach, usually on a temporary basis. All states require certified teachers to have completed a Bachelor's degree program that includes both subject matter and pedagogical studies for an initial credential. Most teachers major in education (primary school teachers) or in a subject matter and take sufficient education courses to obtain certification. Many states have additional requirements for second- and third-stage certification, such as additional courses, a Master's degree, and examinations.

Teacher pre-service education takes place in universities in schools of education. Middle and secondary school teachers generally major in the subject they teach, although this practice varies from state to state. The No Child Left Behind legislation (2001) requires schools in all states to hire only "qualified" teachers—teachers who meet certification requirements. However, because the states set the certification requirements, the definition of a "qualified" teacher varies from state to state.

Nearly all teachers teaching in a particular state are educated and certified in that state. More than 40 of the 50 states require teachers to take a state test to be certified. More recently, national certification programs have been developed that require already practicing teachers to provide portfolios of their teaching and to take a national test in the subject that they intend to teach. However, only a small percentage of teachers apply to be nationally certified. In most states, secondary school teachers must major in the subject they intend to teach.

Teacher salaries

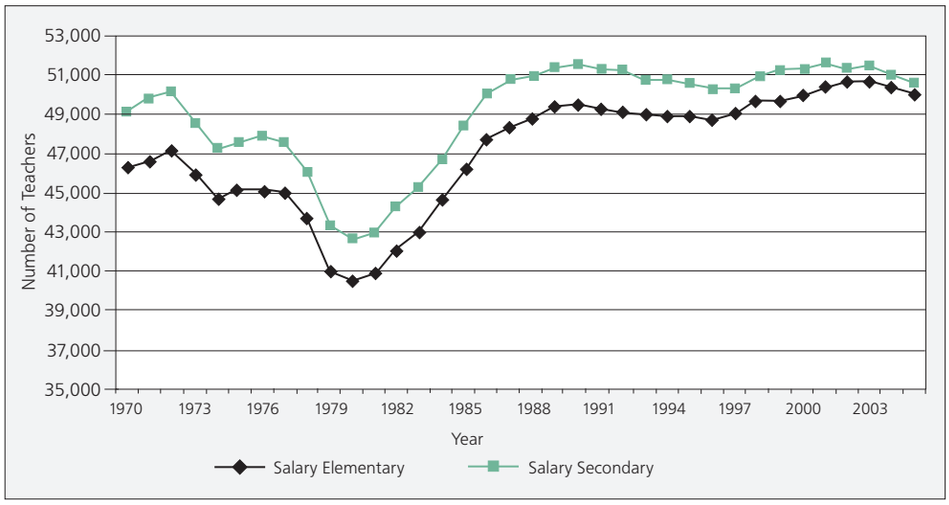
Movements in teacher salaries in the period 1970 to 2005 can be divided into distinct periods. After a rapid rise of average teacher salaries in real terms in the 1960s (an increase of approximately 33%), average salaries fell about 12% in constant dollars in the 1970s, then rose more than 20% in the 1980s (NCES, 2004, Table 77). They have remained more or less constant since (see Figure 71 for the period 1980 to 2002).

The salaries in Figure 71 are averages for the entire United States. However, salaries and changes in salaries for teachers vary greatly from state to state. A quick way to get some idea of this variation is to estimate increases in spending per student between, say, 1980 and 2000. A list of various states (Table 49) shows how great this variation is (the average ratio of real spending per student between 1980 and 2000 was 1.58). The increase in expenditure per student during this 20-year period in states such as Arizona, California, Florida, and Louisiana was much less than the average for the United States as a whole. Spending per student in states such as Georgia, South Carolina, Connecticut, and Texas over this period was considerably more than the average. Although the teacher salary increase was much smaller than the overall increase (20% versus 58%) because of lower teacher–student ratios and rapid increases in the cost of maintenance, transportation, and (especially) special education, we can assume that those states with the greater increases in overall spending per student were also those states where salaries increased.

From the standpoint of recruitment, a main issue is how to keep increasing the number of teachers in the United States if real teacher salaries are not increasing (see Figure 70 above). It is important to keep in mind, however, that while it may be possible to recruit more teachers, the quality of the teachers in terms of their capacity to teach, say, mathematics, will doubtless depend on salaries in competing professions. We examine this issue below.

One of the most important factors affecting both teacher salary increases and recruitment is the rise in the real wages of university-educated females (and females in general) in absolute terms and relative to male wages, over the past 30 years. The single most important explanation for the rapid increase in teacher salaries in the 1980s, for example, is the corresponding rise in female's real wages in that decade. According to estimates by the Economic Policy Institute (Washington, DC), the real wages of female college graduates increased 17% in the 1980s (compared to only a two percent increase

Figure 71: United States, Real Mean Elementary and Secondary Teacher Earnings, 1970 to 2005 (constant 2006/2007 US dollars)



Source: NCES (2008, Table 75).

Table 49: United States, Change in Real Spending per Student, 2000/1980, by State

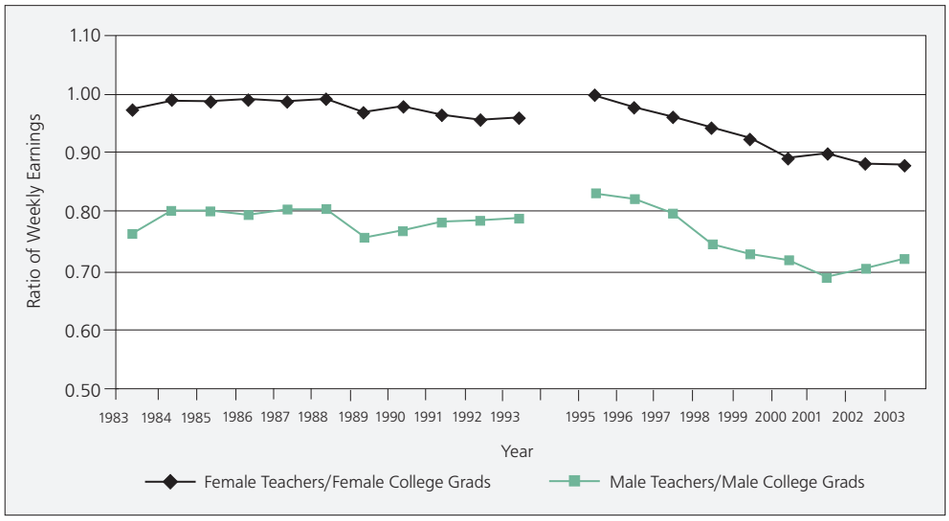
State	Real Spending per Student 2000/1980	State	Real Spending per Student 2000/1980
Arizona	1.30	Massachusetts	1.72
California	1.42	Mississippi	1.70
Connecticut	1.85	New York	1.64
Florida	1.38	North Carolina	1.68
Georgia	2.16	South Carolina	2.01
Illinois	1.57	Texas	1.76
Louisiana	1.31	Virginia	1.78

Source: NCES (2004, Table 167).

in the real wages of male college graduates); real wages for males and females with advanced degrees increased about 15% from 1980 to 1990. This pattern conforms to the 20% increase in teacher salaries in the 1980s. However, in the 1990s, the real wages of female college graduates with advanced degrees continued to increase, albeit at a slower rate, so that during 1990 to 2000, real wages rose more than 10% for these two groups. Wages also rose, by over eight percent, for male college graduates and males with advanced degrees.

According to Allegretto, Corcoran, and Mishel (2004), the weekly wages of teachers declined relative to all college graduates in the period 1983 to 2003, by about 10% for females and 5% for males. But when this decline is re-examined according to various periods of time, it becomes evident that the period after 1996 contributed most to the decline—10% for females and 10% for males. Figure 72 sets out this pattern. The fact that teacher salaries did not rise during the 1990s, particularly during a period of full employment, suggests that, in general, the education system may have been recruiting more teachers with lower levels of ability during this period than it did in the 1960s and 1970s. This is the conclusion that Corcoran, Evans, and Schwab (2002) reached on the basis of their empirical work.

Figure 72: United States, Ratio of Teachers' Weekly Earnings to Weekly Earnings of Other College Graduates of the Same Gender, 1983 to 2003



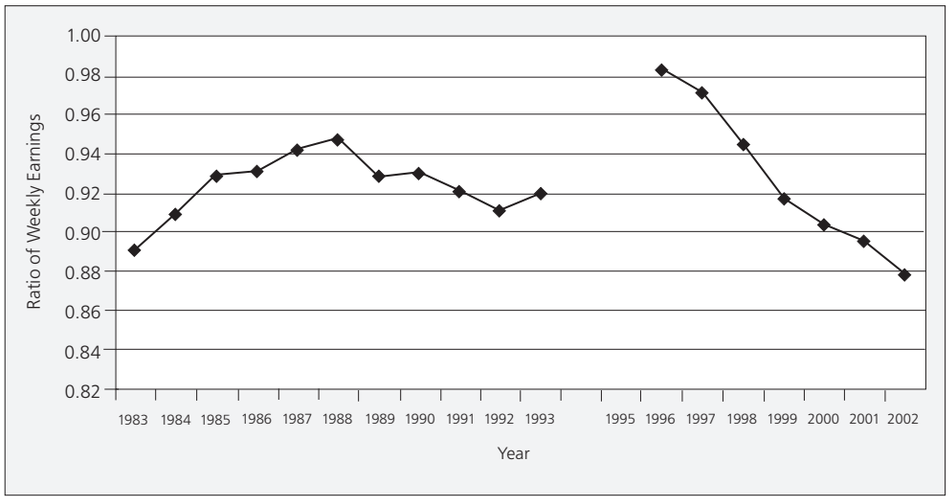
Note: Calculating estimates for 1994 and 1995 was complicated by the fact that the CPS did not indicate imputed wages.
Source: Allegretto et al. (2004, Figure 3).

This pattern varies from state to state, however. If we assume that spending per student correlates with teacher salary increases, what we find is that states such as Massachusetts and Texas, which have consistently increased spending per student more than the national average in each decade since the 1970s, are probably more likely to be attracting better teachers than states whose expenditure per student is much less than the national average. Some states, such as Connecticut, increased teacher salaries by a large amount in the 1980s, specifically to attract higher quality college graduates into teaching. However, spending per student in Connecticut remained almost flat in the 1990s, but if the increase in the 1980s had been large enough, teacher salaries in Connecticut may still have been high enough in more recent years to ensure continued quality of mathematics teaching in that state's schools. If not, we should see evidence of erosion in quality.

Comparisons between Salaries of Teachers and of Other Professionals

The Current Population Survey (CPS), taken every year in the United States, allowed us to estimate teacher income relative to other occupations. Allegretto et al. (2004) used data from the Bureau of Labor Statistics to measure the skill levels of different occupations, including K–12 teaching. On the basis of "points" and "market value" of occupational skill levels, they identified 16 professional and managerial occupations with skill ratings similar to those of K–12 teachers (see Allegretto et al., 2004, Table 5). The ratio of teachers' weekly wages to the weekly wages of these 16 comparable occupations in the 1980s and the 1990s is shown in Figure 73. The reason why the ratio jumps so abruptly in 1996 is that the CPS redesigned the way it estimated teachers' wages, and thereby raised them relative to other wages. But the important point here, as discussed above, is that relative wages fell sharply for teachers in the period 1996 to 2002, a trend that probably increased the cost of recruiting more able individuals into teaching.

Figure 73: United States, Ratio of Teachers' Weekly Earnings to Weekly Earnings of Comparable Professionals, 1983 to 2002



Note: Calculating estimates for 1994 and 1995 was complicated by the fact that the CPS did not indicate imputed wages.

Source: Allegretto et al. (2004, Table 7).

We also used the CPS to estimate age/income profiles for teachers by gender and level of education, comparing their weekly earnings with those of scientists and engineers and those of all others in the labor force with the same level of education in 1995 and 2000. These two years bracket a period of decline in teachers' relative wages. The results are presented in Table 50 and graphically only for individuals with Bachelor's degrees in Figures 74 to 77. The table and the figures suggest that the mean annual incomes of teachers (both males and females) were already lower in 1995 than were the earnings of scientists, engineers, mathematicians, and non-scientists. Teacher earnings became relatively even lower in 2000. Note, though, that these are annual earnings, so the differences are larger than the differences for weekly earnings because teachers work fewer weeks per year than do other professionals. Even after building into our estimation eight weeks less for teachers than for other professionals (40 weeks annually versus 48 weeks), we still found a considerable difference in salary between the two groupings.[31]

Teachers in the United States are paid relatively much less than professionals in competing occupations. If the brighter college students who might consider teaching mathematics or science in middle and high school can also go into industry as a scientist or engineer, the income they have to forego to take up teaching is substantial.

31 One of the advantages of estimating age–income profiles rather than estimating incomes without indicating age is that, on average, those in teaching may be older than other workers. This fact biases comparisons between the earnings of teachers and those in competing occupations, with teachers apparently earning more than workers of the same age in other occupations.

Table 50: United States, Mean Annual Earnings of Teachers, Scientists, Engineers, Mathematicians, and Other College-Educated Workers, by Gender, Level of Education, and Age, 1995, 2000

	Females with Bachelor's Degree, 1995			Males with Bachelor's Degree, 1995		
Age	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*
20–24	25,022	18,670	22,497	25,312	28,547	22,821
25–29	32,419	23,411	27,598	36,414	21,871	32,263
30–34	37,554	25,783	33,505	44,195	29,032	40,781
35–44	39,530	28,428	37,202	51,788	32,604	48,628
45–54	41,657	31,269	36,852	55,076	35,535	52,824
55–64	33,667	32,896	33,101	58,518	47,664	56,306
	Females with Bachelor's Degree, 2000			Males with Bachelor's Degree, 2000		
Age	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*
20–24	31,588	22,831	24,347	30,672	22,556	29,518
25–29	40,877	26,696	33,730	47,978	27,799	40,706
30–34	43,970	28,650	38,731	53,698	30,053	47,799
35–44	49,402	31,271	42,327	61,384	39,279	54,775
45–54	47,503	34,019	42,226	61,198	38,736	57,440
55–64	38,809	41,106	42,555	60,843	42,668	56,489
	Females with Master's Degree, 1995			Males with Master's Degree, 1995		
Age	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*
20–24		24,000	28,122	43,545		41,030
25–29	31,540	28,171	30,480	36,310	30,700	36,139
30–34	36,656	31,477	39,393	49,516	33,552	47,755
35–44	46,000	36,811	43,740	58,133	39,674	58,822
45–54	38,341	39,286	42,876	65,375	45,430	58,311
55–64	48,250	40,495	41,777	61,084	44,591	51,131
	Females with Master's Degree, 2000			Males with Master's Degree, 2000		
Age	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*	*Scientists & Engineers*	*K–12 Teachers*	*Non-Scientists*
20–24	20,667	28,333	23,315	41,500		59,333
25–29	55,429	31,498	44,580	46,969	35,200	47,909
30–34	45,047	37,474	46,382	58,678	36,248	57,484
35–44	57,426	38,968	55,300	66,862	47,090	66,432
45–54	59,564	42,927	52,500	69,989	47,874	64,081
55–64	59,550	47,244	50,590	67,801	40,868	64,519

Source: Bureau of the Census, Current Population Survey, 1995, 2000.

Figure 74: United States, Median Annual Earnings of Males with Bachelor's Degree, 1995

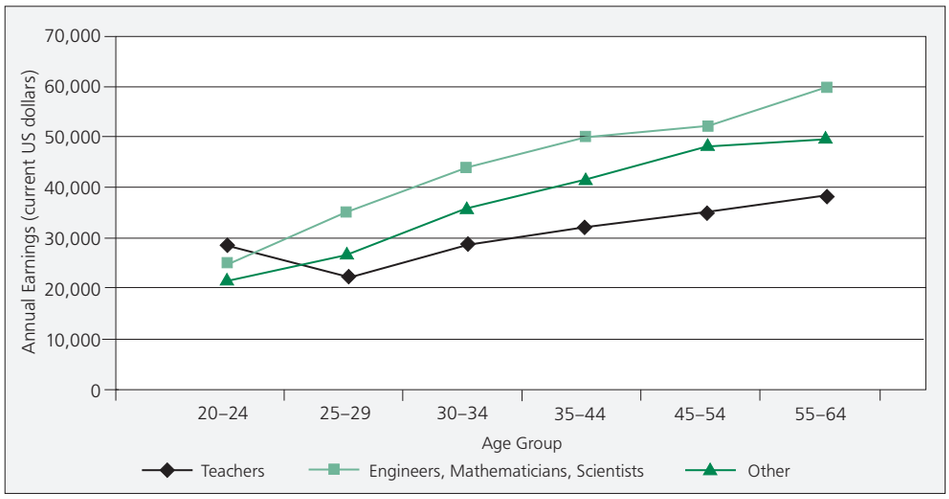


Figure 75: United States, Median Annual Earnings of Females with Bachelor's Degree, 1995

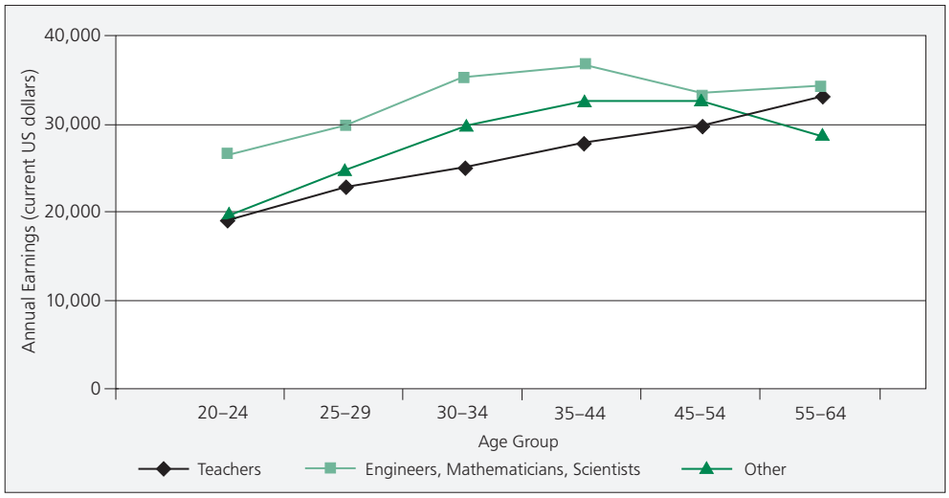


Figure 76: United States, Median Annual Earnings of Males with Bachelor's Degree, 2000

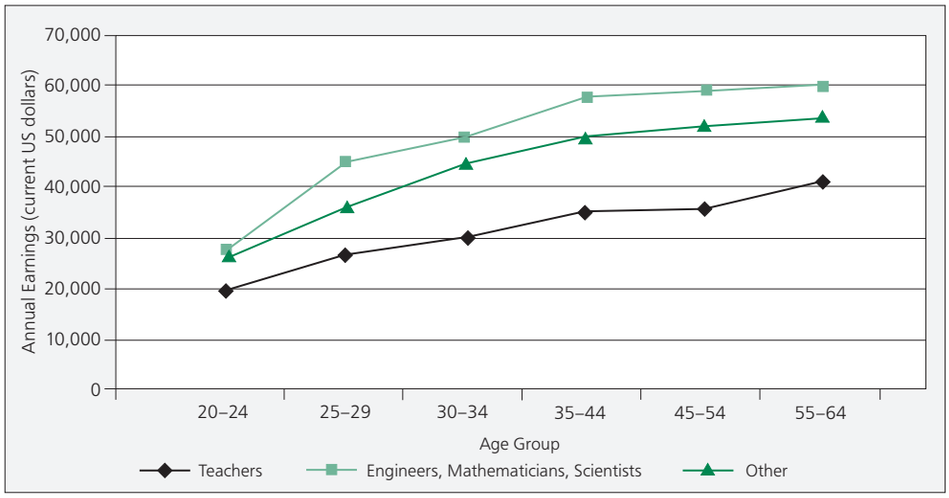
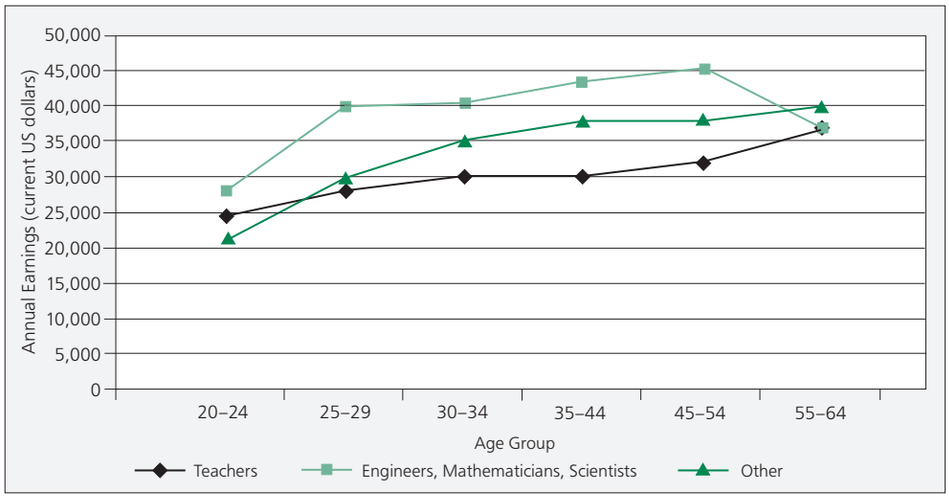


Figure 77: United States, Median Annual Earnings of Females with Bachelor's Degree, 2000



References

Allegretto, S. A., Corcoran, S. P., & Mishel, L. (2004). *How does teacher pay compare? Methodological challenges and answers.* Washington, DC: Economic Policy Institute.

Corcoran, S., Evans, W. N., & Schwab, R. S. (2002). *Changing labor market opportunities for women and the quality of teachers, 1957–1992* (National Bureau of Economic Research working paper 9180). Cambridge, MA: National Bureau of Economic Research. Available online at http://www.nber.org/papers/w9180.

National Center for Educational Statistics (NCES). (2004). *Digest of educational statistics.* Washington, DC: Author.

National Center for Educational Statistics (NCES). (2008). *Digest of educational statistics.* Washington, DC: Author.

This report presents the results of the international study on teachers' relative salaries. The study, conducted alongside the IEA Teacher Education and Development Study in Mathematics (TEDS-M), included 20 countries representing a wide range of economic development levels and national educational policy structures. The countries were Australia, Botswana, Bulgaria, Chile, Chinese Taipei, Finland, France, Germany, Hong Kong SAR, Italy, Republic of Korea, Mexico, Norway, the Philippines, Singapore, Spain, Switzerland, Thailand, the United Kingdom, and the United States.

The data on which the study was based came from various sources: government documents and statistics, official surveys, international statistics (Organisation for Economic Co-operation and Development, the World Bank), and national and international studies, including the IEA Trends in International Mathematics and Science Study (1995, 1999, 2003) and the OECD PISA Programme for International Student Assessment (2001, 2004).

In this report, the authors compare the salaries of primary and secondary school mathematics teachers with the salaries of individuals in other mathematics-oriented professions, such as engineering, scientific research, and accounting. They also investigate the relationship between what mathematics teachers are paid and the scores of lower-secondary school students on TIMSS and PISA. An expected outcome of the study was that the scores of students on the TIMSS and PISA mathematics tests in societies with higher rates of teacher pay would exceed the scores of students in societies with lower rates of teacher pay.

The results partially confirmed this hypothesis: a positive and statistically significant relationship emerged between student performance and teacher salaries in the case of male (not female) teachers. This finding remained constant even when the authors controlled for GDP per capita and income distribution. The authors discuss several possible reasons for this correlation, among them the idea that higher teacher pay draws individuals with higher mathematics skills into teaching, thereby resulting in better student performance. The lack of a close relationship between female teachers' relative salaries and student performance is explained by the notion of a separate dynamic in most societies related to how well women are paid relative to men.