

# Too cool for school? Evidence of declining quality of teachers

Jarle Møen, Kjell Gunnar Salvanes & Helge Sandvig Thorsen

*Very preliminary version*

## Abstract

Quality of teachers is extensively debated, and there seems to be a general concern that the quality is declining. In this paper, we aim to reveal how the cognitive skills of teachers have been evolving over time. If there is evidence of a falling tendency, we want to look more carefully into at which stage of a prospective teacher's career he decides not to teach. A closer look at the quality of students finishing teacher education makes a natural starting point. There are, however, other possible sources of a negative change in quality, as workers with teacher education may choose not to work as teachers. The timing of such selection out of teaching is crucial for policy implications.

As a natural extension of the description of changes in teacher quality, we address the question of why these changes occur. We discuss how trends in cognitive skills of teachers relate to their relative wages.

## Introduction

To the extent that the quality of teachers is declining, it is a substantial concern: According to Hanushek & Rivkin (2006), the literature suggests that teachers' cognitive skills are more important than "other explicit teacher characteristics". As emphasized by Corcoran et al. (2002), the robustness of this finding stands in sharp contrast to the continuing debate over the importance of other inputs into the production of education (per-pupil expenditure, class size etc). Despite the broad consensus on the importance of the profession, the literature on teacher quality is relatively scarce. A main reason is the difficulties attached to measuring "quality." Unique Norwegian IQ data from the military records provide us with an opportunity to have a thorough look at a dimension of quality we expect to be highly relevant.

The *PISA* report (Programme for International Student Assessment) tests different skills of 15-year old students, i.e. reading, mathematics and science. Despite being among the countries with highest expenditures on schooling, Norway does not come out above average at the standardized tests. In the 2006 report, Norwegian students score significantly below average for all topics. Whereas the students are almost back at the OECD average in PISA 2009 (Released in December 2010), the share of students with scores at the top levels has not increased since

the 2006 report. The apparent disproportion between spendings and quality in the Norwegian school makes another reason to study the quality of its teachers.

In this paper, we aim to reveal selection out of teaching. We will consider the cognitive skills of workers with a teacher education, and the cognitive skills of the *teaching* teachers. From a sample of all workers with a teacher education, a substantial share does not work as teachers at the peak of their career. One could suspect that the relative share of high quality teachers is higher among the leavers, as they are likely to have better outside options.

## Data

*Quality* of teachers is not easy neither to define, observe, or measure. Teachers differ at a wide range of characteristics, and they use a broad specter of their personal skills in their daily work. Unlike most other work on quality of labour, however, we have access to cognitive test score from the military records. This score is available for all Norwegian men from the cohort of 1950 and onwards. IQ has proved to be strongly correlated with numerous characteristics that are attached to success in the labour market, including performance in school and wages. An attraction of this particular IQ score, is the fact that it is collected at an age at which the person is about to make his educational choice. Together with extensive Norwegian register data, this provides us with an unique opportunity to consider this dimension of the quality of teachers. To the extent that there has been a declining quality, we expect the IQ score to capture this.

It deserves to be mentioned that the most important skills of an efficient teacher need not be the same as the characteristics correlated with success in the general labour market. Even if this is the case, however, a study of the cognitive skills of teachers may give useful insight. Trends in teachers' position in the distribution illustrates the status of the profession, and which part of the cohort eventually goes into teaching.

The fact that the major share of teachers are female, raises a potential problem of our data. In order to reveal the true changes in teacher quality, we need a way to look into the quality of female teachers. Bacolod (2007) gets around this by looking at the scores of the female teachers' partners, in accordance with the theory of positive assortative mating. We will make use of its correlation with brothers' score, in order to gain insight of the cognitive skills of female teachers.

As we consider potential explanations of trends in quality of teachers, the register data are useful as they contain annual individual information, e.g. earnings, education and profession. The data do not, however, go further back than 1986. As we aim to reveal trends for a longer

period, we include information from two additional data sources to illustrate trends for earlier years. The introduction of Norwegian social security dates back to 1967, and this provides us with annual data on pension giving earnings. These data do not include any information but the earnings. By combining social security data with census data from 1970 and 1980, however, we are able to attach education and occupation to the observations. The censuses offer extensive data on the full population for the years in which they were implemented.

We expect the censuses to identify the major part of the teachers in the data from 1967 to 1985. It deserves to be mentioned, however, that this approach is not quite as detailed as the one for the series from 1986. Whereas the register data provide us with an opportunity to follow changes in education and occupation from one year to another, we are down to one or two observations for each person in earlier periods. Hence, a worker will be considered a teacher if he has a teacher education at the time of the census. The categories defining education and occupation are also slightly different in the part of the series for which register data are unavailable. Nevertheless, we expect the combination of censuses and data from social security to be fairly equivalent to the more extensive register data.

## Literature

Several papers look into teacher quality, providing results from different countries. For USA, Corcoran et al. (2002), and Bacolod (2007) are among the most cited papers. Corcoran et al. (2002) utilize surveys of five cohorts of high school students. By a series of logit models, they calculate the probability of becoming a teacher, conditional on test score ranking. The study suggests a modest fall in teacher quality for female teachers. Women at the top decile of the distribution, however, are a lot less likely to become teachers than before. This is in accordance with Bacolod's (2007) main findings. Bacolod looks more explicitly into the effect of the new and better opportunities for women outside of teaching. Whereas 41% of the teachers born in 1940 are among the top 20% of the cohort, this share falls to 19% for the 1960 cohort.

Nickell & Quintini, (2002) gives UK evidence for declining quality of teachers. Their starting point is the decline in public sector pay in Britain, and they look for evidence of falling quality of workers in different public services. Nickell & Quintini find that the change in quality of teachers is caused by the men, as opposed to the evidence from USA. Nickell & Quintini base their analysis on survey data of people at the age of 10, 11, and 16.

## Incentives to choose teacher education

There might be several reasons why the teacher education is unable to attract the best students. A natural starting point is the relative wages. IQ scores enable us to look at how "ability" is valued across studies and professions. Figure 2 illustrates average earnings at the age of 33, for men holding a college/university degree. The age of 33 is chosen in order to minimize the gap between lifetime earnings and current income. This is in accordance with several papers, including Bhuller, Mogstad & Salvanes (2011). By distinguishing between teachers and non-teachers, a clear pattern reveals: First, the returns to teacher studies are lower than the returns to other studies. Second, this difference increases with IQ score, implying that high-skilled workers have stronger incentives not to become teachers.

Figure 2 does not give information on how the incentives of becoming a teacher has changed over time. One way to gain insight of this is to look at how the average wages of teachers has been evolving relative to workers with other educations. As a first approach, Figure 3 illustrates the average wages of workers at the age of 33, for teachers and everyone but teachers, respectively. Figure 4 offers an alternative presentation of the same data as Figure 3. In this figure, we plot wages of teachers relative to wages of other workers.

As the group of "everyone but teachers" is likely to change along characteristics such as education, the comparisons of Figure 4 does not necessarily tell the full story of relative teacher wages. In order to gain some additional insight, we plot teacher wages relative to workers with a degree in nursing or business, respectively. Figure 5 illustrates teacher wages relative to business school graduates, whereas Figure 6 illustrates how teacher wages score relative to workers with a nursing education.

A visual inspection of the curves suggests a strong tendency of declining relative wages of teachers. The comparisons with nurses and business school graduates are both in accordance with previous illustrations of teacher wages: During the time span we consider, teachers experience a substantial decrease of wages, relative to both business school graduates, nurses, and the general wage level.

## Preliminary evidence of declining quality

The *Flynn effect* implies that new generations tend to score better than previous generations at IQ tests. Figure 7 illustrates how the average IQ scores have changed over the cohorts. Hence, a look at the raw mean does not necessarily give the full picture of how the relative IQ of teachers

is evolving over time. An illustration of the change in teacher quality creates a need to define to whom we want to compare the teachers. Most of the literature gets around this by letting teachers' position in the IQ distribution of their cohort define their quality. This corresponds to a comparison with the full non-teacher population.

Figure 8 illustrates the average percentile of workers with teacher education. The figure suggests a falling trend in the score of male teachers, in accordance with the results of Nickell & Quintini (2002). Whereas teachers' score is relatively stable for the cohorts born during the 60s, there are substantial decreases for the cohorts of the 1950s, and from the mid 1970s. Fredriksson & Öckert (2007) study ability rank of Swedish college graduates. They find a teacher specific fall in the mid 1970s. This is in accordance with Figure 8.

There has been a substantial increase in the share of women in the teacher profession. The declining cognitive skills of male teachers is less of a problem if female teachers of high quality tend to replace the male teachers. The fact that the cognitive test scores of women are unavailable, makes an analysis of female teachers less straightforward. As previously mentioned, Bacolod (2007) gets around this by utilizing the scores of the teachers' partners. An alternative approach to get insight into female cognitive skills, is to make use of its correlation with brothers' score. An advantage of this strategy is that we can get an idea of its reliability by calculating the correlation between brothers. Figure 9 illustrates the average position of female teachers, when their score is defined by the (average) score of their brother(s).

From a visual inspection of Figure 9, it might seem like female teachers are located in a lower part of the distribution than their male colleagues. This is a conclusion that needs a word of caution. Note that for the first cohorts, the average percentile of male teachers is close to 0.7. Hence, the teachers are clearly at the upper part of the distribution of cognitive skills. The higher scores of teachers, the more likely they are to score above the average of their siblings. To the extent that teachers are positively selected from their family, there will be a gap between the rank of the teacher and the rank of his/her non-teaching brothers.

Recall that Figure 9 does not give an explicit illustration of the score of female teachers relative to the score of other women. Rather, the figure shows how the brothers of female teachers score, relative to other men. With this in mind, the declining tendency is probably more interesting than the level. Hence, our figures suggest a decreasing trend in quality of both male and female teachers.

Both Corcoran et al. (2002) and Bacolod (2007) reveal a modest fall in teacher quality at

the average. On the top of the distribution, however, the changes are a lot more pronounced. As our preliminary findings suggest a relatively strong declining trend for teachers, it will be interesting to look more closely into at which part of the distribution this occurs. As a first attempt to test whether the pattern of the U.S. papers holds for Norwegian data, Figure 9 illustrates the share of teachers and non-teachers scoring 8-9 at the test. The test scores follow a stanine distribution, i.e. it is standard normally distributed with a mean of 5 and standard deviation of 2. Around 10% of each cohort scores 8 or 9. Note that "Non-teachers" are still workers holding a university/ college degree.

For the major part of the series, we hardly see a relative decline for teachers. For the cohorts of the mid 1970s, however, there may seem to be a teacher specific fall. Nevertheless, Figure 9 does not give support for the hypothesis that the major part of the changes in teacher quality happens at the top decile of the distribution.

Figure 8 is based on a sample of everyone who can be classified as teachers by their education. Even though the figure illustrates a declining trend for those, it does not necessarily tell the full story of the evolvement of teacher quality. People with teacher education does not always end up in the teacher profession. If an increasing share of the most able teacher students decides not to go into teaching, the true decline in quality of teachers is even larger than our figures suggest. Although it takes a thorough analysis to consider selection of teachers out of teaching, Figure 11 offers a first glimpse. From a sample of everyone holding a teacher degree, we look at the average IQ score by teaching status. The horizontal axis denotes number of years since completion of teacher education. The figure supports the concern that high-skilled teachers are leaving the profession. Of obvious reasons, we are down to the older cohorts when we consider the most experienced teachers. As the cognitive score of workers with teacher education was higher for previous cohorts, the figure illustrates an increasing trend.

## **Where to go?**

Figure 11 suggests selection of qualified teachers out of the profession. We aim to have a closer look at the extent of this selection, and get a better understanding of its timing. This will be important for policy implications.

In the initial analyses, we use a wide definition of teachers. Whereas every teacher has some kind of teacher education, the extent and form of this education varies. Some teachers hold an education of two or three years, others finished a masters degree. An extension of the

preliminary analyses will be to consider different kinds of teachers separately. We aim to pin down how teachers with education at different levels have scored over time. It will be interesting to look into both the changes in wages and the cognitive scores for these groups separately. Teachers may also be separated by the level of school at which they are teaching. We aim to look into whether the decline of cognitive skills of teachers is valid both for the elementary school, middle school, and high school.

In addition to a more thorough study of the trends, we intend to look more carefully into possible explanations of declining quality of teachers. As previously mentioned, relative teacher wages makes a natural starting point, but sex composition and business cycles is also worth looking into.

## References

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- [5] Fredriksson, P. & Öckert, B. (2007), The supply of skills to the teacher profession, IFAU
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## Figures

Figure 1: Share of male teachers

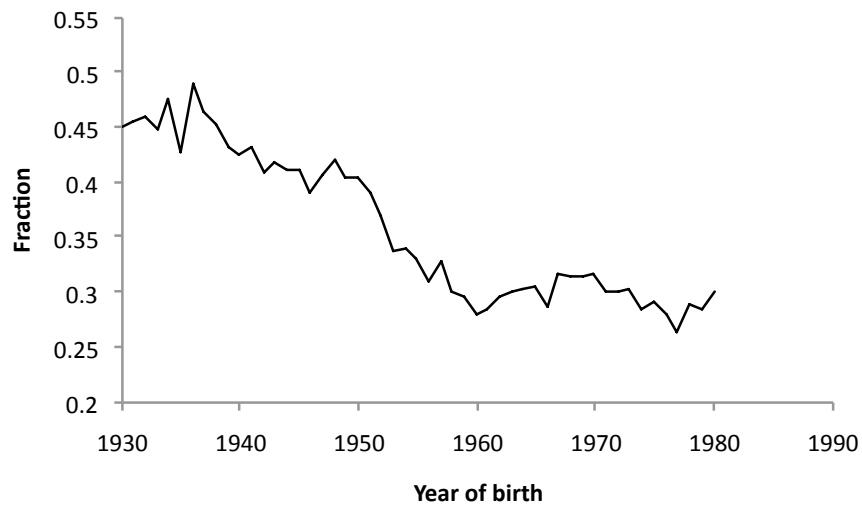


Figure 2: Returns to IQ score

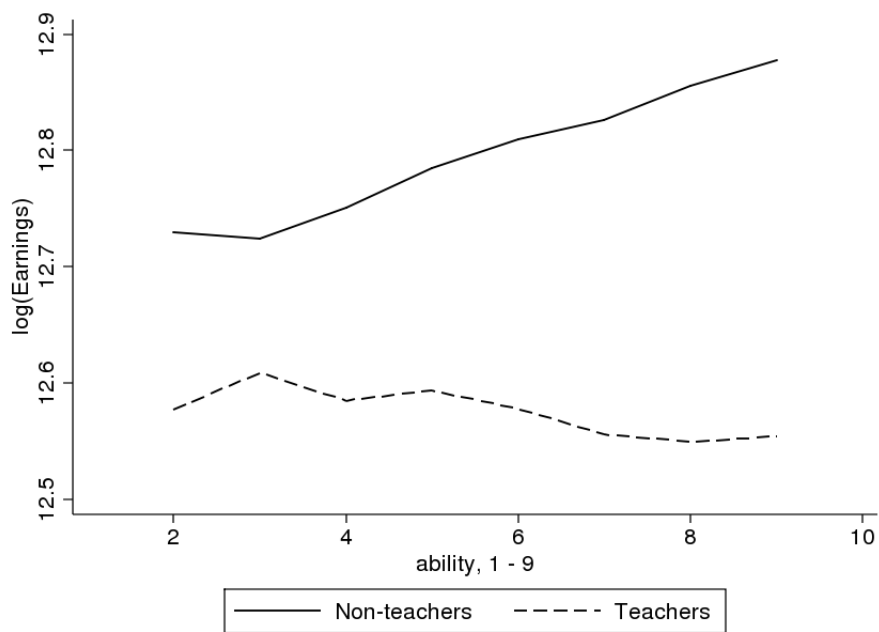


Figure 3: Earnings of teachers and everyone but teachers

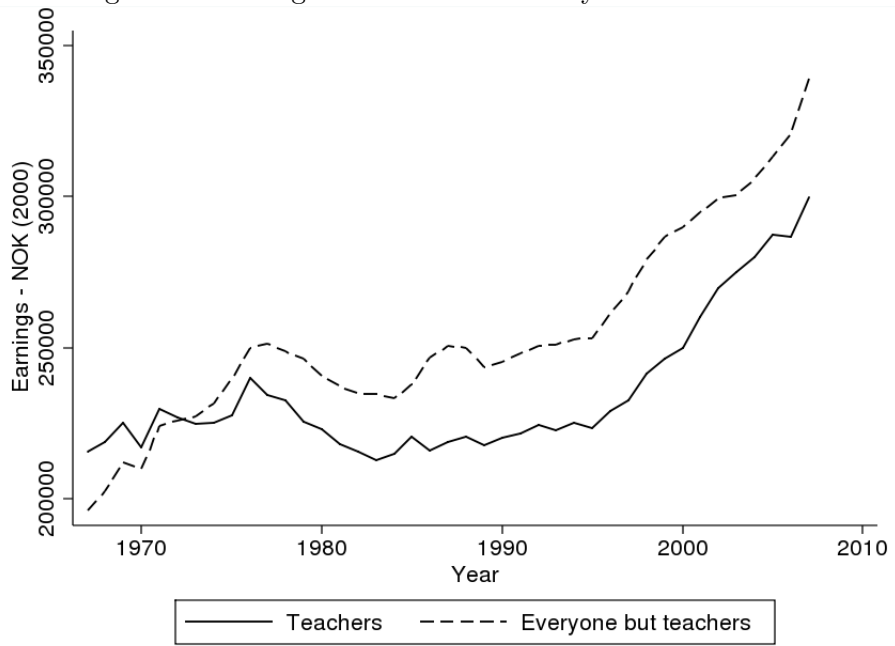


Figure 4: Teacher earnings, relative to everyone but teachers

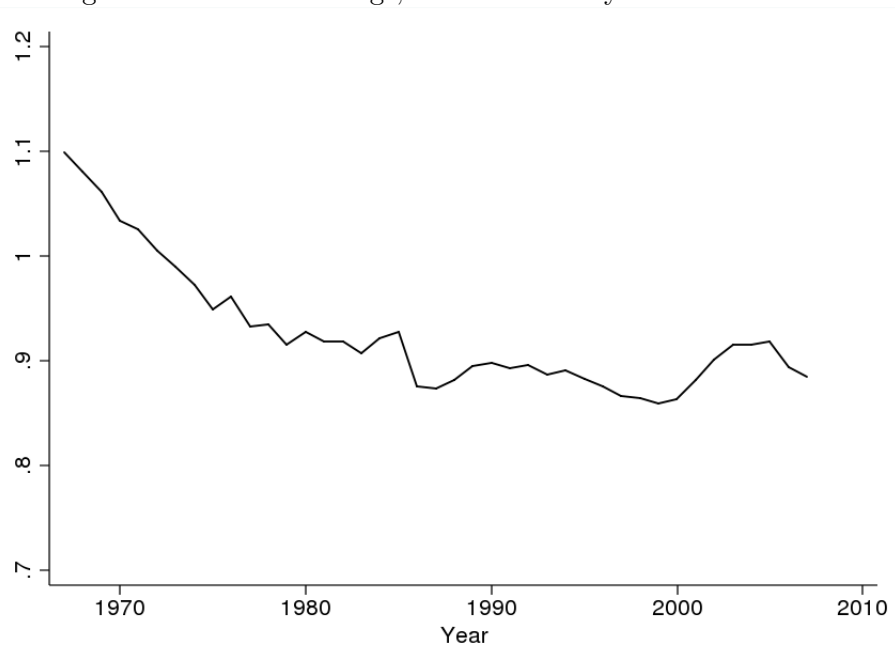


Figure 5: Teacher earnings, relative to business school graduates



Figure 6: Teacher earnings, relative to nurses

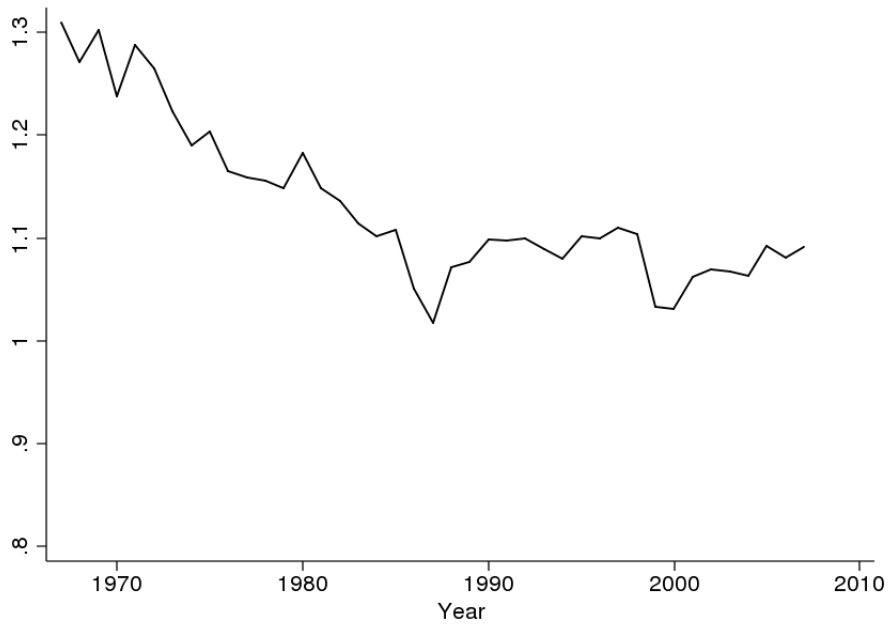


Figure 7: The Flynn effect, and the Flynn effect coming to an end



Figure 8: Cognitive test scores: Average position of male teachers

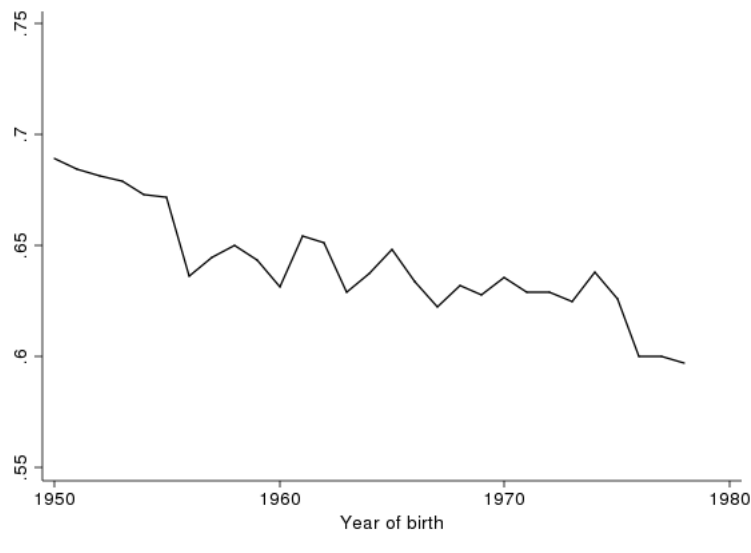


Figure 9: Cognitive test scores: Female teachers

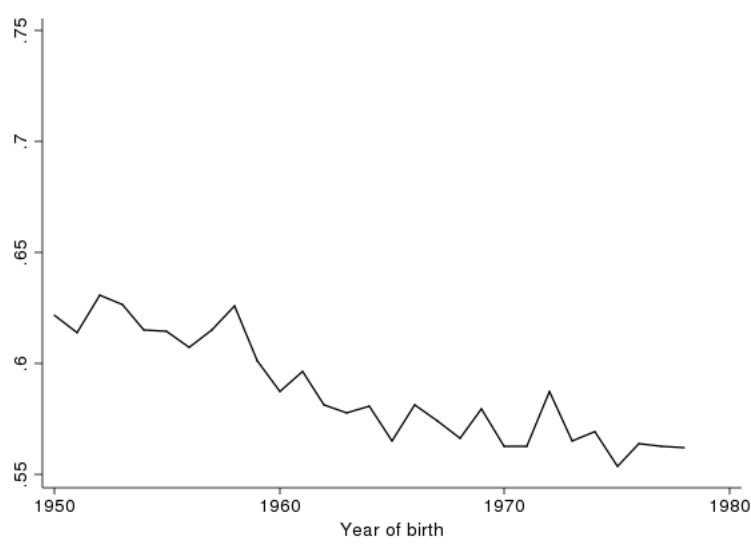


Figure 10: Share of college/university graduates scoring 8-9

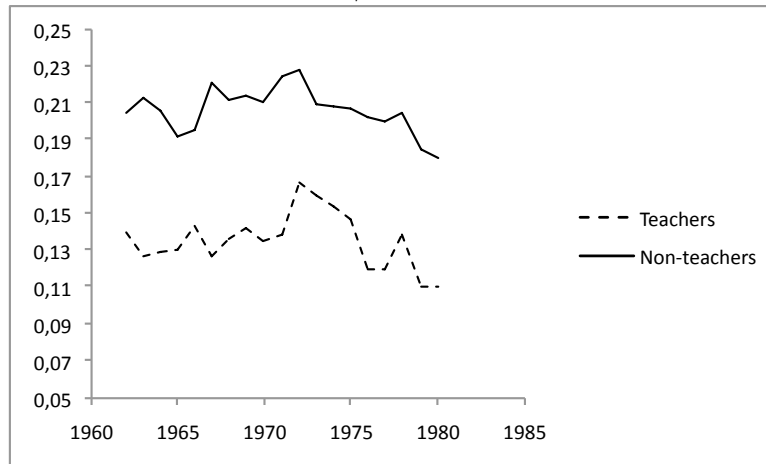


Figure 11: Average IQ of teachers, by teaching status

