IFAU – INSTITUTE FOR LABOUR MARKET POLICY EVALUATION

Gender and ethnic interactions among teachers and students – evidence from Sweden

Erica Lindahl

WORKING PAPER 2007:25

The Institute for Labour Market Policy Evaluation (IFAU) is a research institute under the Swedish Ministry of Employment, situated in Uppsala. IFAU's objective is to promote, support and carry out scientific evaluations. The assignment includes: the effects of labour market policies, studies of the functioning of the labour market, the labour market effects of educational policies and the labour market effects of social insurance policies. IFAU shall also disseminate its results so that they become accessible to different interested parties in Sweden and abroad.

IFAU also provides funding for research projects within its areas of interest. The deadline for applications is October 1 each year. Since the researchers at IFAU are mainly economists, researchers from other disciplines are encouraged to apply for funding.

IFAU is run by a Director-General. The institute has a scientific council, consisting of a chairman, the Director-General and five other members. Among other things, the scientific council proposes a decision for the allocation of research grants. A reference group including representatives for employer organizations and trade unions, as well as the ministries and authorities concerned is also connected to the institute.

Postal address: P O Box 513, 751 20 Uppsala
Visiting address: Kyrkogårdsgatan 6, Uppsala
Phone: +46 18 471 70 70
Fax: +46 18 471 70 71
ifau@ifau.uu.se
www.ifau.se

Papers published in the Working Paper Series should, according to the IFAU policy, have been discussed at seminars held at IFAU and at least one other academic forum, and have been read by one external and one internal referee. They need not, however, have undergone the standard scrutiny for publication in a scientific journal. The purpose of the Working Paper Series is to provide a factual basis for public policy and the public policy discussion.

ISSN 1651-1166

Gender and ethnic interactions among teachers and students – evidence from Sweden[♣]

by

Erica Lindahl*

October 16, 2007

Abstract

This study investigates the importance of gender and ethnic interactions among teachers and students for school performance in Swedish, English and Mathematics. School leaving certificates assigned by the teacher is compared with results on comprehensive national tests. The analysis is based on data on grade 9 students (age 16) from Sweden. I find that a student is likely to obtain better test scores in Mathematics, when the share of teachers of the same gender as the student increases. Correspondingly, ethnic minority students, on average, obtain better test scores in Mathematics, when the share of ethnic minority teachers increases. The positive same-gender effect on test scores is counteracted by a *negative* assessment effect. That is, conditional on test scores, same-gender teachers are less generous than opposite-gender teachers when assessing students' performance. In Swedish and English no statistically significant effects are found.

Keywords: School achievements, student and teacher interactions, gender, race
JEL-codes: I21

[♣] I am grateful for useful suggestions and comments from Per Johansson, Peter Fredriksson, Tuomas Pekkarinen, Helena Holmlund and Andreas Westermark as well as seminar participants at the Department of Economics, Uppsala University, participants at the First Summer School of the Marie Curie Research Training Network, Padova, 16-18 June 2006 and participants at the COST meeting in Essen, 19-20 October 2006. The financial support from the Swedish council for working life and social research FAS (dnr 2004-1212) is acknowledged.
[*] Department of Economics, Uppsala University, e-mail: erica.lindahl@nek.uu.se.

Table of contents

1 Introduction

According to test scores, there are persistent differences in school performance between the genders and ethnic groups. International studies show that girls, on average, outperform boys in Reading while the opposite is true in Mathematics (NAEP 1999; PISA 2003). On Swedish national tests, girls score higher than boys in Reading (Swedish and English) while there are no significant differences in Mathematics (Skolverket, 2006; Nycander, 2006; Lindahl, 2007). Further, students that belong to the ethnic majority outperform students from ethnic minorities. For example, in the US, white students, on average, outperform black and Hispanic students (NAEP 2004). In Sweden, native students outperform immigrants in all core subjects according to national test scores (Lindahl 2007).

Another picture emerges when school performance is measured with school leaving certificates, which in Sweden are based on evaluations by the teachers. According to those, girls outperform boys in almost *all* subjects, including Mathematics. In Reading, the gender differences are even larger than what would be expected from corresponding test scores (Skolverket, 2006; Nycander, 2006; Lindahl 2007). Studies from different countries show that girls, on average, are better rewarded than boys in teacher evaluations, irrespective of their relative performance on the corresponding tests (Emanuelsson and Fischbein, 1986). A suggested explanation to this observation is that the school environment might be adapted to traditionally female behaviour.[1] Lindahl (2007) shows that teachers' evaluations differ from the corresponding tests, also with respect to the ethnic background of the students. In school leaving certificates, the difference between native and non-native students are less pronounced than in the national test scores.

The gender and ethnic differences in school performance could potentially be explained by a non-representative composition of the teacher staff with respect to gender and ethnicity. In Sweden, male teachers are under-represented in Reading, and non-native teachers are under-represented in general. Educationalists, for example Einarsson (1981) and Hultman (1981), have claimed that the teachers' gender affect how they devote time and attention to boys and girls

[1] See Emanuelsson and Fischbein for a more extensive review of this literature.

(for a discussion see Emanuelsson and Fischbein, 1986). The same reasoning has been applied to ethnic interactions (Ferguson, 1998; and Casteel, 1998). Others have suggested that teachers serve as role-models for their students (Bettinger and Long, 2004). That is, students with the same gender or ethnicity as the teacher may more easily identify themselves with the teacher and thereby perform better in the school. A few studies on data from England and the US suggest that students with the same gender or ethnicity as the teacher perform better on test scores than others (Ammermueller and Dolton, 2006; Dee, 2005b; Dee, 2001). Further, evidence from the US suggests that same race, as well as same gender, of the teacher and the student, is important for the teacher's perception of the student's behaviour and performance (Ehrenberg, Goldhaber and Brewer, 1995; Dee, 2005a and 2005b).

The aim of this study is to examine if students perform better in school, when the share of teachers of the same gender or ethnic background as the student increases. That is, do boys perform better if the share of male teachers increases? Correspondingly, do ethnic minority students perform better if the share of ethnic minority teachers increases? As measurements of performance, I use both test scores *and* the corresponding assessments by the teacher, i.e., the school leaving certificates. Thus, I am able to compare how test scores are affected in comparison to assessments.

The analysis is partly based on Swedish data on grade 9 students (16 years old). For each student, information is available about gender and country of birth as well as test scores and school leaving certificates in Swedish, English and Mathematics. This information is matched with school-level data on the gender- and ethnic composition of the teacher staff.

The following results are found in Mathematics. On average, students perform better on the test when the share of the same-gender teachers increases. Correspondingly, minority students, on average, perform better when the share of minority teachers increases. The effect sizes correspond to around 4.2 and 27 per cent standard deviations of the test score distribution with respect to gender and ethnicity, respectively. In school leaving certificates, the positive same-gender effect on test scores is counteracted by a *negative* assessment effect. That is, conditional on test scores, same-gender teachers are less generous than opposite-gender teachers in their assessment. This negative effect corresponds to 3 per cent of the standard deviations of the test score distribution in Mathematics with respect to gender. With respect to ethnicity, there is no evidence of an assessment effect. In Swedish and English, no statistically significant effects are found.

2 School leaving certificates and test scores

The Swedish educational system relies heavily on school leaving certificates. They are used as a selection instrument for higher education as well as in job applications. The teacher alone is responsible for assigning the school leaving certificate. However, the Swedish National Agency for Education formulates the criteria for different grade steps. In the latest curriculum for the Compulsory School System (Lpo, 94) it is stated that school leaving certificates should reflect skills and knowledge in the subject in accordance to the goals stated in the course syllabi. It is also clearly stated that school leaving certificates should *not* reflect attention in the classroom, diligence, ambition, home works and work during lesson, as long as it is not a prerequisite for attaining the goals (as in the case of laboratory work).

National tests are performed during the spring semester in grade 9. The tests in languages (Swedish and English) measure writing and reading abilities as well as listening comprehension and verbal interaction. The tests in Mathematics include analysis and algebra and an oral part testing mathematical reasoning. The tests are corrected at the school level but are graded according to national stated correcting instructions. Teachers are encouraged to not correct their own students' exams, but they are allowed to do so.

Teachers *shall* use the nationally approved tests when assigning the school leaving certificate (Skolverket 2004). However, in the individual case, the teacher is free to assign the school leaving certificate differently from the test score. The reason is that the student might be low-performing on the test day due to occasional conditions. Further, the teacher should take into consideration all available information about the student's knowledge and ability in the subject. The tests do not capture *all* goals stated in the course syllabi, although the aim of the tests is to measure, as comprehensively as possible, the student's ability and knowledge in the subject. However, it is clear from the national directives that the tests should form an important basis for the school leaving certificates.

Both school leaving certificates and test scores are assessed according to the same ordinal metrics: Fail (F), Pass (P), Pass with Distinction (PD) and Pass with Special Distinction (PSD). The aim of the Swedish school is that all students should attain at least "Pass". To be qualified for upper secondary school, the student has to attain at least "Pass" in the three core subjects Swedish, English and Mathematics.

3 Data

3.1 Data sources

The main data source used is a register, provided by the Swedish Agency for Education (SAE), of school leaving certificates for all students in grade 9 in Sweden (årskurs 9 registret). This register contains the gender and age of the student, which year and which school the student attended in grade 9. This information is combined with an additional register about teachers (lärarregistret). The teacher register contains information on what school and in which subject each teacher teaches as well as the gender of the teacher. Finally, information about test scores, collected by SAE is added. I use test scores from year 2001 to 2005.[2] Between 2001 and 2002, test scores from a random sample of 150 schools were collected. From 2003 and onwards all schools were ment to be collected. However, all subjects are not collected all years. Swedish and English are not collected in 2002 and 2003 and Mathematics is missing in 2001. Since the availability of test scores differs between the three different subjects, one sample is constructed for each subject. These samples are restricted to include all covariates of interest (no missing value of any covariate). All results presented are based on these restricted samples. The sample sizes in the gender case are 109,204 in Swedish, 111,623 in English and 268,334 in Mathematics.

In the ethnic background case, an additional register (Louise) is used: a register from Statistics Sweden about country of birth. At present, this information is available for all students younger than 17 in 2003. Students in Sweden are expected to reach the age of 16 in grade 9. Thus, country of birth is

[2] A stratified sample of test scores is collected between 1998 and 2001.

only available for students who graduated before 2004. The samples used in this case are: 7,766 in Swedish, 8,579 in English and 69,149 in Mathematics.

3.2 Variable definitions

Unfortunately, the information about which subject each teacher teaches is not precise. The information is given by a code indicating if the teacher is teaching within a subject block. The subject blocks relevant in this study are: 1) Mathematics and Science (used for teachers in Mathematics), 2) Social Sciences and Swedish (used for teachers in Swedish) and 3) Swedish and languages (used for teachers in English). Thus, the information about which subject the teachers teach is more precisely measured in Mathematics than in Swedish and English.

The teacher information is matched with the student information via a school code. Thus, I only have information about the *share* of female and minority teachers at the school.

In Sweden many individuals are born in another Nordic country than Sweden. Those individuals speak Swedish well, look Swedish and know the country well. Ethnic minority students are therefore defined as those born in a non Nordic country.

For students with another language than Swedish as mother tongue and who are assessed to not be able to follow the ordinary course in Swedish, a special course is offered: *Swedish 2*. The *Swedish 2* course has about the same course syllabus as the ordinary course in Swedish but the teaching is adapted for students with another mother tongue than Swedish. Since 2001, the national test is the same for the course *Swedish 2* as for the ordinary course in Swedish. In this paper *Swedish 2* and Swedish are treated as one subject.[3] The focus in this paper is on student and teacher interactions. Thus, the type of course the student has taken within the subject should be of less importance.

The Swedish National Agency for Education summarizes the school leaving certificate (all final course grades) into a total Grade Point Average (GPA). This GPA is the instrument used for application to higher education. The values used for transforming the ordinal scale to a numerical scale in order to calculate the GPA are: 0, 10, 15 and 20. Fail equals 0, Pass equals 10 and Pass with distinction and Pass with special distinction equals 15 and 20,

[3] Controlling for Swedish 2 does not affect any of the interaction estimates presented in this paper.

respectively. All results presented in this study are based on grades transformed to these numerical values.

3.3 Sample selection

Except for test scores, all information used stems from register data containing all students in grade 9 in Sweden. However, test scores are only available for a selected group of students. That is, if test scores from the school are reported to SAE and if the student has completed all parts of the test. Test scores shall be reported to SAE by the school and all students are requested to complete all parts of the test. Despite these requests, I may have a selection of schools and/or students within schools. *Table 1a* in the Appendix presents descriptive statistics on all covariates used. Both unrestricted and restricted (the samples used in the analysis) are presented for all three subjects.

The most striking difference is that the mean in school leaving certificates is somewhat higher in the restricted samples. A plausible explanation is that those students who did not complete all parts of the test on average perform worse than those who did. Further, the share of unqualified teachers is lower in the restricted samples.

In the ethnic samples, there are differences in mean values also with respect to other covariates. The reason is probably that the number of schools that did not report test scores decreases between 2003 and 2005. In the ethnic background analysis, data until 2003 are used while data until 2005 are used in the gender analysis. The share of minority students is somewhat lower in the restricted samples in Swedish and Mathematics. Further, the teachers' mean age is lower in the restricted samples in Swedish and English.

The conclusion is that this analysis is based on students who on average perform (according to school leaving certificates) slightly above the average in Sweden, in comparison to the overall population.

4 Descriptive statistics

Table 1a and *Table 1b* presents the gender and ethnic differences in means according to school leaving certificates and test scores, respectively. The first column reports the share of female (minority) teachers in each subject. The fourth and the last column presents the correlation between the share of female (ethnic minority) teachers and the gender (ethnic) difference, at the school level, in test scores and school leaving certificates, respectively.

According to test scores, girls outperform boys in Swedish and English while there is no statistically significant difference in Mathematics. According to school leaving certificates, girls outperform boys in all subjects. Thus, in line with other studies, *Table 1a* shows that the gender gap in favour of girls seems to be reinforced in teachers' evaluations, compared to the corresponding test scores.

Female teachers dominate in Swedish and English; the shares of female teachers in these subjects are 62 per cent and 83 per cent, respectively. In Mathematics, the gender composition among teachers is almost balanced; 46 per cent of the teachers in Mathematics are female.

If girls perform better with a female teacher, we would expect the positive gender gap in favour of girls at the school level to be positively correlated with the share of female teachers at the school. Except for test scores in Swedish, there is a positive correlation between the share of female teachers and the difference between the performance of girls and boys. This correlation is largest in Swedish with respect to school leaving certificates.

Minority students on average perform below natives in all subjects. This is true both according to school leaving certificates and test scores. According to test scores, the gap is smallest in English while it is smallest in Swedish according to school leaving certificates. Thus, also in this case, the size of the gap depends on how school performance is measured.

The share of minority teachers is largest in English, 11 per cent, and smallest in Swedish, 2 per cent. In Mathematics the share is 7 per cent. Again, except for school leaving certificates in English, there is a positive correlation between the share of minority teachers and the difference in performance between minority and majority students. This correlation is largest in Mathematics with respect to test scores.

The correlations reported in *Table 1a* and *Table 1b* are suggestive of an association between the composition of teachers and the relative performance of students with certain characteristics. However, to estimate if the gender and ethnic balance among teachers has a *causal* effect on the performance of girls and minority students, we need a formal model.

Table 1a Difference in tests scores and school leaving certificates between genders and the share of female teachers in respective subject

	Tests scores					*School leaving certificates*			
Subject	Share female teachers (Std. dev)	Average grade (Std. dev)		Difference (Std. dev)	Correlation: the share of female teachers and the gender gap at the school	Average grade (Std. dev)		Difference (Std. dev)	Correlation: the share of female teachers and the gender gap at the school
		Girls	Boys			Girls	Boys		
Swedish	0.62	13.40	11.29	2.11	-0.0275	14.30	11.99	2.31	0.0345
	(0.32)	(4.06)	(4.31)	(0.02)		(4.09)	(4.04)	(0.02)	
English	0.83	13.47	13.05	0.41	0.0017	13.77	12.92	0.85	0.0016
	(0.24)	(4.31)	(4.48)	(0.02)		(4.35)	(4.41)	(0.02)	
Math	0.46	11.24	11.22	0.02	0.0283	12.69	12.30	0.39	0.0131
	(0.30)	(5.18)	(5.15)	(0.02)		(4.22)	(4.22)	(0.02)	

Table 1b Difference in tests grades and school leaving certificates between ethnic minority and ethnic majority students and the share of ethnic minority teachers in respective subject

	Tests scores					*School leaving certificates*			
Subject	Share minority teachers (Std. dev)	Average grade (Std. dev)		Difference (Std. dev)	Correlation: the share of minority teachers and the ethnic gap at the school	Average grade (Std. dev)		Difference (Std. dev)	Correlation: the share of minority teachers and the ethnic gap at the school
		Minority	Majority			Minority	Majority		
Swedish	0.02 (0.08)	10.82 (4.46)	12.48 (3.99)	-1.66 (0.10)	0.0107	12.06 (4.20)	13.25 (4.07)	-1.19 (0.10)	0.0092
English	0.11 (0.21)	11.93 (4.75)	13.13 (4.08)	-1.20 (0.10)	0.005	12.21 (4.83)	13.42 (4.14)	-1.22 (0.10)	-0.0011
Math	0.07 (0.17)	9.07 (5.37)	11.48 (4.76)	-2.41 (0.06)	0.0582	10.97 (4.31)	12.51 (4.03)	-1.55 (0.05)	0.0153

5 Econometric model

For ease of exposition I only refer to the gender case in the following. The same reasoning is applicable for the ethnic case -- just replace “female student” by “non-native student”.

5.1 Identification

The correlation between the gender gap in school performance and the gender balance among teachers does not necessarily imply a *causal* relationship. That is, it is not necessarily the case that female teachers *cause* better performance of girls in comparison to boys. For example, it *might* be the case that girls inherently excel in readings. This fact *may* in turn imply that female teachers, to a higher degree than male teachers, choose to teach in reading.

In order to estimate a potential *causal* effect for a girl of having a female teacher, I have to control for gender-specific student and teacher characteristics that also influence school performance. In this study the information about teachers is at the school level. Thus, selection of students and teachers within schools is not an issue. However, I still might have sorting of both students and teachers between schools.

Both the gender of the student and the share of female teachers at the school may be correlated with the status of the school. In Sweden, there are large differences across schools both according to national test scores and according to school leaving certificates (Skolverket, 2007). Thus, schools may have an independent effect on test scores and school leaving certificates. Self-selection of students and teachers to schools may result in a positive association between the gender of the student and the gender of the teacher, although no such causal relationship exists. In order to take care of selection of students and teachers between schools, I apply a difference-in-differences strategy. I control for both the gender of the student and the share of female teachers at the school. The parameter of interest is then the parameter in front of the interaction between these two terms. This parameter can be interpreted as the additional effect for girls of an increase in the share of female teachers by one per centage point.

In order to examine the difference between any potential effect on test scores and any potential effect on school leaving certificates, I also include a dummy for type of grade (school leaving certificates or test scores). By interacting all independent variables also with type of grade, I am able to study how a potential effect on school leaving certificates – an assessment effect – works in addition to a potential effect on test scores.

5.2 Estimation

The grade steps in Sweden are ordinal. This fact suggests an *ordered probit* or an *ordered logit* model. However, the results from a linear model are easier to interpret and established numerical values exist for the ordinal scale. Thus, a linear model is a good approximation. The following model is estimated with ordinary least squares.

$$Y_{ijst} = \beta_0 + \beta_1 f_{it} + \beta_2 T_{ijt} + \beta_3 f_{it} T_{ijt} +$$
$$\beta_4 F_{st} + \beta_5 f_{it} F_{st} + \beta_6 F_{st} T_{ijt} + \beta_7 f_{it} F_{st} T_{ijt} + \eta_t + \varepsilon_{ijst}$$

where Y_{ijst} is individual *i*'s type of grade *j* (school leaving certificate or test score) in school *s*, year *t*; *f* is a dummy for being female. Furthermore, *T* is a dummy for the type of grade where *T* equals 1 if the grade corresponds to school leaving certificates and 0 if the grade is test scores. *F* denotes the share of female teachers in the subject. The term η_t captures year effects[4] and ε_{ist} is the assumed idiosyncratic error term.

The parameter estimates of interest are the ones in front of the interaction between the gender of the student (*f*) and the share of female teachers at the school (*F*). A student-teacher interaction effect on test scores is captured by β_5 . If an increase in the share of female teachers positively affects girls' performance on the test, β_5 is positive. By interacting the term ($f_{it} F_{st}$) also with the type of grade, we capture an additional student-teacher interaction effect associated with school leaving certificates. That is, β_7 measures whether female teachers, in comparison with their male colleagues and conditional on any student teacher interaction effect on test scores, favour their own gender when assigning school leaving certificates. This is the potential assessment effect.

[4] I estimate a static linear panel data model. However, the sample covers several years and some schools are observed several times. A year specific dummy is therefore included to capture which year the individual is observed. Including year dummies imply that we do not have to worry about changes in grade policy (grade inflation) over time. Wikstrom and Wikstrom (2004) claim that grade inflation occurs in Sweden during the 1990s.

The model specification above takes care of potential selection between schools as long as girls do not self select to certain schools *because* there is a large share of female teachers (or the other way round, teachers choose school depending on the students). However, if a high share of girls at the school attracts female teachers (or vice versa) *and* if this selection is correlated with the outcome variable, β_6 and β_8 are not consistently estimated. With respect to ethnicity, this type of selection may exist due to preferences for teachers/students with a similar cultural background. In order to remedy this potential bias I add school dummies. With school dummies included in the model, I explore the variation within schools over time.

When the estimation stems from variation within schools over time, I have to assume that the error term should not be correlated with the explanatory variables across time periods, in order to receive consistent estimates. This assumption is violated if teachers, conditional on all covariates, assign extraordinary high grades in year *t* and this fact in turn affects students' or teachers' choices of schools the following year. This could be a real problem if students and/or teachers choose schools depending on the school results the previous year. However, it is presumably more realistic to assume that school choice is based on average results from several years, in which case this is not an issue.

In order to increase the precision of the estimates, I also add the following covariates: the share of female (minority in the ethnic case) students at the school, the student's age, the mean age of the teachers in the subject at the school, the share of unqualified and only generally unqualified teachers at the school.[5] In the ethnic case, I also include the share of female teachers. The estimates of these additional covariates are not presented.[6]

In all model specifications, inferences presented are based on standard errors that accommodate heteroscedasticity at the school level. This is appropriate since the sampling unit with respect to test scores is schools.

---

[5] Unqualified teachers are those who lack formal subject specific training while generally unqualified teachers are those who lack formal pedagogical training.

[6] The reason for *not* including the non-native dummy in the gender case is that this information would reduce the sample size. It is reasonable to assume that, β_5 and β_7 in the gender case are orthogonal to the information about the student's country of birth. Thus, the country of birth information would probably not affect the parameter estimates, only the precision of the estimates.

6 Results

Table 2a presents the results for the gender case and *Table 2b* the results for the ethnicity case.

A statistically significant (at the 5 per cent level) student-teacher interaction effect is found in Mathematics on test scores. The effect remains when adding school dummies and additional covariates (column 2). The interpretation is that female students on average perform better on the test if the share of female teachers in the subject increases with one per centage point. The effect size of this parameter (0.220 credit points) corresponds to around 4.2 per cent of the standard deviation of the test score distribution in Mathematics. If we extrapolate the result, the estimated effect has the following interpretation. A *10 per centage* point increase in the share of female teachers at the school, improves girls' test scores by around 2 credit points. This effect corresponds to a half grade step between "Pass" and "Pass with Distinction". The result could also be interpreted from the perspective of boys, i.e., male students on average perform better on the test if the share of male teachers in the subject increases.

The student teacher interaction effect associated with school leaving certificates – the assessment effect – is also statistically significant but *negative*. This effect is unaffected by the inclusion of school dummies and additional covariates (column 2). The *negative* assessment effect is more than half of the effect size found on test scores and corresponds to 3 per cent of the standard deviation of the test score distribution in Mathematics. Thus, when school performance is measured with school leaving certificates, the positive effect on test scores is counteracted by a negative assessment effect. It is therefore key how school performance is measured. A negative assessment effect associated with school leaving certificates, could explain why Holmlund and Sund (2006) and Skolverket (2006) did not find any positive effects when using school leaving certificates on Swedish data as the outcome variable.

In Swedish and English, neither the parameter intended to capture a student teacher effect on test scores, nor the parameter intended to capture an assessment effect, are statistically significant. The non-precisely estimated effects are close to zero, suggesting that no student teacher interaction effects exist in these subjects.

The other parameter estimates of the model also show interesting phenomena. Some of these results are discussed in Lindahl (2007) in which the focus is on the gender difference when comparing school leaving certificates and test scores. However, in addition to the results presented in Lindahl (2007), the model in this study shows that a larger share of female teachers in Mathematics is associated with better test scores for male students. Since male students' test scores correspond to the reference category in the model, the estimate on the share of female teachers, *F*, show this.

With respect to ethnicity, the parameter estimate of the interaction effect on test scores in Mathematics becomes twice as large and statistically significant when school dummies are included in the model (compare column 1 and 2). Thus, in this case, school dummies probably take care of some selection. The interpretation of this result is that a one per centage point increase in the share of minority teachers at the school in Mathematics, positively affects minority students with around 1.4 credit point, on average. This effect size corresponds to around 27 per cent of the standard deviation of the test score distribution in Mathematics.

Also in this case, a negative assessment effect is found. However, the estimate is not precisely estimated. Compared to the estimated assessment effect in Mathematics with respect to gender, the estimated effect size is much larger but the standard error is also significantly larger.

In Swedish and English none of the interaction parameters of interest are statistically significant. The non-precisely estimated effects on test scores are positive and about the same size as the corresponding estimated effect in Mathematics. However, the standard errors are larger. An explanation for the lack of precision could be the smaller sample sizes used in Swedish and English, compared to Mathematics. In addition, the information about which subject the teachers teach is less precisely measured in Swedish and English than in Mathematics.

Table 2a Interacting share of female teachers at the school in the subject and female student, parameter estimates from ordinary least squares estimation: (1) Basic (2) Covariates and school dummies added

	Swedish		English		Math	
	(1)	(2)	(1)	(2)	(1)	(2)
Female student (f)	2.158	2.083	0.453	0.332	-0.083	-0.164
	(0.080)***	(0.080)***	(0.150)***	(0.143)**	(0.053)	(0.052)***
Type of grade (T)	0.723	0.723	-0.016	-0.016	1.122	1.122
	(0.054)***	(0.054)***	(0.081)	(0.081)	(0.043)***	(0.043)***
Interaction: f* T	0.174	0.174	0.475	0.475	0.432	0.432
	(0.051)***	(0.051)***	(0.069)***	(0.069)***	(0.033)***	(0.033)***
Share of female teacher (F)	0.061	0.285	0.413	-0.132	0.443	0.321
	(0.139)	(0.282)	(0.222)*	(0.272)	(0.126)***	(0.150)**
Interaction: F*f	-0.100	-0.079	-0.128	-0.108	0.241	0.220
	(0.121)	(0.121)	(0.175)	(0.167)	(0.102)**	(0.098)**
Interaction: T*F	-0.043	-0.043	-0.199	-0.199	-0.154	-0.154
	(0.081)	(0.081)	(0.095)**	(0.095)**	(0.079)*	(0.079)*
Interaction: T*F*f	0.053	0.053	-0.005	-0.005	-0.161	-0.161
	(0.078)	(0.078)	(0.082)	(0.082)	(0.062)***	(0.062)***
Constant	11.264	-3,755.895	12.649	-4,985.313	6.993	-4,464.324
	(0.130)***	(107.190)***	(0.209)***	(123.213)***	(1.552)***	(76.468)***
Observations	218408	218408	223246	223246	536668	536668
R-squared	0.07	0.16	0.01	0.10	0.02	0.09

Standard errors in parentheses are clustered on schools, all models include year dummies, * significant at 10 %; ** significant at 5 %; *** significant at 1 %, the number of observations is twice the number of students since the dataset is stacked; for each student there are two grades: school leaving certificates and test scores

Table 2b Interacting share of ethnic minority (non Nordic-born) teachers at the school in the subject and ethnic majority (non Nordic-born) born student, parameter estimates from ordinary least squares estimation: (1) Basic (2) Covariates and school dummies added

	Swedish		English		Math	
	(1)	(2)	(1)	(2)	(1)	(2)
Non Nordic-born student (n)	-1.666	-1.119	-1.487	-0.958	-1.704	-1.330
	(0.331)***	(0.227)***	(0.380)***	(0.268)***	(0.097)***	(0.093)***
Type of grade (T)	0.775	0.775	0.178	0.178	0.860	0.860
	(0.056)***	(0.056)***	(0.055)***	(0.055)***	(0.033)***	(0.033)***
Interaction: n* T	0.412	0.412	0.046	0.046	0.798	0.798
	(0.157)***	(0.157)***	(0.120)	(0.120)	(0.069)***	(0.069)***
Share of non Nordic-born teacher (N)	1.616	23.552	0.044	12.638	-0.130	-0.600
	(1.257)	(17.479)	(0.365)	(19.896)	(0.342)	(0.943)
Interaction: N*n	1.546	1.389	1.574	1.036	0.755	1.409
	(1.734)	(1.116)	(1.261)	(0.732)	(0.522)	(0.478)***
Interaction: T*N	-0.588	-0.588	0.155	0.155	0.275	0.275
	(0.457)	(0.457)	(0.257)	(0.257)	(0.227)	(0.227)
Interaction: T*N*n	0.228	0.228	0.469	0.469	-0.431	-0.431
	(1.233)	(1.233)	(0.471)	(0.471)	(0.312)	(0.312)
Constant	8.612	-2,000.461	10.834	-3,584.255	8.578	-4,437.277
	(1.368)***	(416.921)***	(1.318)***	(410.854)***	(0.433)***	(188.460)***
Observations	15532	15532	17158	17158	138298	138298
R-squared	0.03	0.17	0.02	0.13	0.05	0.12

Standard errors in parentheses are clustered on schools, all models include year dummies, * significant at 10 %; ** significant at 5 %; *** significant at 1 %, the number of observations is twice the number of students since the dataset is stacked; for each student there are two grades: school leaving certificates and test scores

7 Conclusion

In Mathematics, girls and ethnic minority students on average would perform better on the national test if the share of female or ethnic minority teachers, respectively, increases. The result could also be interpreted from the perspective of boys and native students, i.e., boys and ethnic majority students on average would perform better on the national test if the share of male or ethnic majority teachers, respectively, increases. This effect suggests that teachers serve as role models or that the student-teacher interaction itself induces a positive effect on students' performance. However, when school performance is measured with school leaving certificates – assigned by the teacher – this positive effect is reduced. The reason is that school leaving certificates are associated with a *negative* assessment effect. In the gender case, this effect is statistically significant. That is, female teachers are on average less generous than their male colleagues when assigning school leaving certificate to girls. Lindahl (2007) shows that conditional on test scores, girls are more generously rewarded in school leaving certificates than boys. In this study it is shown that female teachers in Mathematics seem to counteract this tendency.

References

Ammermueller A and Dolton P (2006) “Pupil-Teacher Gender Interaction Effects on Scholastic Outcomes in England and the USA”, Discussion Paper No. 06-060, ZEV, Centre for European Economic Research

Bettinger E and Long B (2005) “Do Faculty Serve as Role Models? “The Impact of Instructor Gender on Female Students” *The American Economic Review*

Casteel C A (1998) “Teacher-Student Interactions and Race in Intergrated Classrooms” *Journal of Educational Research 92:* 115-120

Dee T (2001), “Teachers, Race and Student Achievement in a Random Experiment”, *Review of Economics and Statistics*, vol.8681, pp.195-210

Dee T (2005a) “A Teacher Like Me: Does Race, Ethnicity or Gender Matter? *American Economic Review*, vol.95(2), pp..158-65

Dee T (2005b), “Teachers and the Gender Gaps in Student Achievement”, National Bureau of Economic Research, Working Paper 11660

Ehrenberg R, Goldhaber D and Brewer D (1995) “Do Teachers' Race, Gender, and Ethnicity Matter?” Evidence from NELS88, *Industrialand Labor Relations Review 48(3): 547-561*

Emanuelsson I and Fischbein S (1986) “Vive la Difference? A study on Sex and Schooling”, *Scandinavian Journal of Educational Research* 30, 71-84

Einarsson J (1981) Report 5:1981 from the Department of Subject Methodology and theory (Swedish) at the university of Lund. Language and Sex Project.

Ferguson R F (1998) “Teachers’ Perceptions and Expectations and the Black-White Test Score Gap”, in *The Black-White Test Score Gap* C. Jencks and M. Philips, editors, Brookings Institution Press Washington DC, 1998

Holmlund H and Sund K (2007) “Is the Gender Gap in School Performance Affected by the Sex of the Teacher?”, *Labour Economics*

Hultman (1981) Report 6:1981 from the Department of Subject Methodology and theory (Swedish) at the university of Lund. Language and Sex Project.

Lindahl (2007) “Comparing teachers’ assessments and national tests – evidence from Sweden”

Lpo 94, Curriculum for the Compulsory School System, the Pre-School Class and the Leisure-time Centre Lpo 94

NAEP 2004 Trends *in Academic Progress – Three Decades of Student Performance in Reading and Mathematics*, US Department of Education, Institute of Education Sciences, NCES 2005-464

Nycander M (2006), “Pojkar och flickors betyg - En statistisk undersökning”, Institutionen för lärarutbildning, Uppsala universitet

PISA 2003 *Problem Solving for Tomorrow’s World*, First Measures of Cross-Curricilar Competencies from PISA 2003, Programme for International Student Assessment, OECD

Skolverkets allmänna råd 2004 *Allmänna råd och kommentarer Likvärdig bedömning och betygsättning*

Skolverket (2006) ”Könsskillnader i måluppfyllelse och utbildningsval”, rapport nr 286.

Skolverket (2007) ”Provbetyg - Slutbeyg – likvärdig bedömning?”, rapport nr 300

Wikström C and Wikström M (2004), ”Grade inflation and school competition: an empirical analysis based on the Swedish upper secondary schools”, *Economics of Education Review* 24:309-322

Appendix

Table 1a Sample selection in Swedish, gender case

	Unrestricted data			Restricted data	
	Observations	*Mean*	*St dev*	*Mean*	*St dev*
Female student	556,087	0.49	0.50	0.49	0.50
Student's month of birth	556,087	6.29	3.37	6.34	3.38
Student's year of birth	556,087	1987.06	1.67	1988.72	1.05
School leaving certificate	546,536	12.84	4.49	13.12	4.24
Share of female teacher	526,230	0.59	0.28	0.59	0.27
Mean teacher age in subject	526,230	41.33	7.27	41.89	6.96
Share unqualified teachers in subject	526,230	0.19	0.23	0.16	0.21
Share generally qualified teachers in subject	526,230	0.08	0.15	0.08	0.16
Test score[1]	113,568	12.31	4.38	12.33	4.35
Number of observations, when no of above covariates are missing	109,204				

[1] The restricted sample is almost defined by those students who have completed all parts of the national test. However, since there are some missing information also in register data, the sample of students for who national score results exist, is slightly reduced.

Table 1b Sample selection in English, gender case

	Unrestricted data			Restricted data	
English Gender	*Observations*	*Mean*	*St dev*	*Mean*	*St dev*
Female student	556,087	0.49	0.50	0.49	0.50
Student's month of birth	556,087	6.29	3.37	6.29	3.36
Student's year of birth	556,087	1987.06	1.67	1988.10	0.89
School leaving certificate	546,536	12.90	4.81	13.33	4.43
Share of female teacher	526,943	0.84	0.19	0.84	0.18
Mean teacher age in subject	526,943	43.25	7.07	43.54	6.66
Share unqualified teachers in subject	526,943	0.31	0.26	0.28	0.24
Share generally qualified teachers in subject	526,943	0.06	0.13	0.06	0.13
Test score[1]	115,361	13.28	4.46	13.28	4.44
Number of observations, when no of above covariates are missing	111,623				

[1] The restricted sample is almost defined by those students who have completed all parts of the national test. However, since there are some missing information also in register data, the sample of students for who national score results exist, is slightly reduced.

Table 1c Sample selection in Mathematics, gender case

	Unrestricted data			Restricted data	
Mathematics Gender	*Observations*	*Mean*	*St dev*	*Mean*	*St dev*
Female student	556,087	0.49	0.50	0.49	0.50
Student's month of birth	556,087	6.29	3.37	6.29	3.36
Student's year of birth	556,087	1987.06	1.67	1988.10	0.89
School leaving certificate	546,536	11.95	4.65	12.50	4.23
Share of female teacher in subject	539,823	0.46	0.24	0.47	0.23
Mean teacher age in subject	539,823	41.85	6.63	42.47	5.97
Share unqualified teachers in subject	539,823	0.26	0.23	0.24	0.21
Share generally qualified teachers in subject	539,823	0.08	0.14	0.08	0.13
Test score[1]	273,099	11.27	5.17	11.27	5.16
Number of observations, when no of above covariates are missing	268,334				

[1] The restricted sample is almost defined by those students who have completed all parts of the national test. However, since there are some missing information also in register data, the sample of students for who national score results exist, is slightly reduced.

Table 1d Sample selection in Swedish, ethnic case

	Unrestricted data			Restricted data	
	Observations	*Mean*	*St dev*	*Mean*	*St dev*
Female student	556,087	0.49	0.50	0.49	0.50
Student's month of birth	556,087	6.29	3.37	6.34	3.40
Student's year of birth	556,087	1987.06	1.67	1985.03	0.36
School leaving certificate	546,536	12.84	4.49	13.07	4.12
Share of non Nordic-born teachers	526,230	0.02	0.07	0.03	0.09
Mean teacher age in subject	526,230	41.33	7.27	35.22	6.79
Share female teachers in subject	526,230	0.59	0.28	0.61	0.32
Share unqualified teachers in subject	526,230	0.19	0.23	0.24	0.28
Share only generally unqualified teachers in subject	526,230	0.08	0.15	0.10	0.18
Non Nordic-born students	320,123	0.09	0.29	0.08	0.28
Test score[1]	113,568	12.31	4.38	12.28	4.09
Number of observations, when no of above covariates are missing	7,766				

[1] The restricted sample is almost defined by those students who have completed all parts of the national test. However, since there are some missing information also in register data, the sample of students for who national score results exist, is slightly reduced.

Table 1e Sample selection in English, ethnic case

	Unrestricted data			Restricted data	
	Observations	*Mean*	*St dev*	*Mean*	*St dev*
Female student	556,087	0.49	0.50	0.49	0.50
Student's month of birth	556,087	6.29	3.37	6.32	3.40
Student's year of birth	556,087	1987.06	1.67	1985.03	0.34
School leaving certificate	546,536	12.90	4.81	13.23	4.36
Share of non Nordic-born teachers	526,943	0.10	0.16	0.11	0.22
Mean teacher age in subject	526,943	43.25	7.07	37.73	7.64
Share female teachers in subject	526,943	0.84	0.19	0.82	0.27
Share unqualified teachers in subject	526,943	0.31	0.26	0.47	0.36
Share only generally unqualified teachers in subject	526,943	0.06	0.13	0.05	0.17
Non Nordic-born students	320,123	0.09	0.29	0.09	0.28
Test score[1]	115,361	13.28	4.46	13.02	4.30
Number of observations, when no of above covariates are missing	8,579				

[1] The restricted sample is almost defined by those students who have completed all parts of the national test. However, since there are some missing information also in register data, the sample of students for who national score results exist, is slightly reduced.

Table 1f Sample selection in Mathematics, ethnic case

	Unrestricted data			Restricted data	
	Observations	*Mean*	*St dev*	*Mean*	*St dev*
Female student	556,087	0.49	0.50	0.48	0.50
Student's month of birth	556,087	6.29	3.37	6.40	3.35
Student's year of birth	556,087	1987.06	1.67	1986.85	0.38
School leaving certificate	546,536	11.95	4.65	12.38	4.08
Share of non Nordic-born teachers	539,823	0.07	0.14	0.06	0.13
Mean teacher age in subject	539,823	41.85	6.63	42.28	6.06
Share female teachers in subject	539,823	0.46	0.24	0.45	0.23
Share unqualified teachers in subject	539,823	0.26	0.23	0.26	0.21
Share only generally unqualified teachers in subject	539,823	0.08	0.14	0.08	0.13
Non Nordic-born students	320,123	0.09	0.29	0.08	0.28
Test score[1]	273,099	11.27	5.17	11.44	4.76
Number of observations, when no of above covariates are missing	69,149				

[1] The restricted sample is almost defined by those students who have completed all parts of the national test. However, since there are some missing informatio also in register data, the sample of students for who national score results exist, is slightly reduced.

Publication series published by the Institute for Labour Market Policy Evaluation (IFAU) – latest issues

Rapporter/Reports

2007:1 Lundin Daniela ”Subventionerade anställningar för unga – en uppföljning av allmänt anställningsstöd för 20–24-åringar”

2007:2 Lundin Daniela, Eva Mörk & Björn Öckert **”**Maxtaxan inom barnomsorgen – påverkar den hur mycket föräldrar arbetar?”

2007:3 Bergemann Annette & Gerard van den Berg ”Effekterna av aktiv arbetsmarknadspolitik för kvinnor i Europa – en översikt”

2007:4 Junestav Malin ”Socialförsäkringssystemet och arbetsmarknaden – politiska idéer, sociala normer och institutionell förändring – en historik”

2007:5 Andersson Christian ”Lärartäthet, lärarkvalitet och arbetsmarknaden för lärare”

2007:6 Larsson Laura & Caroline Runeson ”Effekten av sänkt sjukpenning för arbetslösa”

2007:7 Stenberg Anders ”Hur påverkar gymnasialt komvux löneinkomster och vidare studier?

2007:8 ”Forslund Anders & Kerstin Johansson ”Lediga jobb, arbetssökande och anställningar – den svenska matchningsfunktionen”

2007:9 Kennerberg Louise ”Hur förändras kvinnors och mäns arbetssituation när de får barn?”

2007:10 Nordin Martin ”Invandrares avkastning på utbildning i Sverige”

2007:11 Johansson Mats & Katarina Katz ”Underutnyttjad utbildning och lönegapet mellan kvinnor och män”

2007:12 Gartell Marie, Ann-Christin Jans & Helena Persson ”Utbildningens betydelse för flöden på arbetsmarknaden”

2007:13 Grönqvist Hans & Olof Åslund ”Familjestorlekens effekter på barns utbildning och arbetsliv”

2007:14 Lindqvist Linus ”Uppföljning av plusjobb”

2007:15 Sibbmark Kristina ”Avidentifierade jobbansökningar – erfarenheter från ett försök i Göteborgs stad”

2007:16 Hesselius Patrik & Malin Persson ”Incitamentseffekter och Försäkringskassans kostnader av kollektivavtalade sjukförsäkringar”

2007:17 Eriksson Stefan & Jonas Lagerström ”Diskriminering i anställningsprocessen: resultat från en Internetbaserad sökkanal”

2007:18 Eriksson Robert, Oskar Nordström Skans, Anna Sjögren & Olof Åslund ”Ungdomars och invandrades inträde på arbetsmarknaden 1985–2003”

2007:19 Agerström Jens, Rickard Carlsson & Dan-Olof Rooth ”Etnicitet och övervikt: implicita arbetsrelaterade fördomar i Sverige”

2007:20 Bennmarker Helge, Kenneth Carling & Anders Forslund ”Vem blir långtids-arbetslös?”

2007:21 Edmark Karin ”Strategisk konkurrens i kommuners utgiftsbeslut för barn-omsorg, skola och äldreomsorg”

2007:22 Lindahl Erica ”Systematiska avvikelser mellan slutbetyg och provresultat – spelar elevens kön och etniska bakgrund roll?”

2007:23 Lindahl Erica ”Spelar lika kön och etnisk bakgrund på lärare och elever roll för provresultat och slutbetyg?”

Working Papers

2007:1 de Luna Xavier & Per Johansson “Matching estimators for the effect of a treatment on survival times”

2007:2 Lundin Daniela, Eva Mörk & Björn Öckert “Do reduced child care prices make parents work more?”

2007:3 Bergemann Annette & Gerard van den Berg “Active labor market policy effects for women in Europe – a survey”

2007:4 Andersson Christian “Teacher density and student achievement in Swedish compulsory schools”

2007:5 Andersson Christian & Nina Waldenström “Teacher supply and the market for teachers”

2007:6 Andersson Christian & Nina Waldenström “Teacher certification and student achievement in Swedish compulsory schools”

2007:7 van den Berg Gerard, Maarten Lindeboom & Marta López ”Inequality in individual mortality and economic conditions earlier in life”

2007:8 Larsson Laura & Caroline Runeson “Moral hazard among the sick and unemployed: evidence from a Swedish social insurance reform”

2007:9 Stenberg Anders “Does adult education at upper secondary level influence annual wage earnings?”

2007:10 van den Berg Gerard “An economic analysis of exclusion restrictions for instrumental variable estimation”

2007:11 Forslund Anders & Kerstin Johansson “Random and stock-flow models of labour market matching – Swedish evidence”

2007:12 Nordin Martin "Immigrants' return to schooling in Sweden"

2007:13 Johansson Mats & Katarina Katz "Wage differences between women and men in Sweden – the impact of skill mismatch"

2007:14 Gartell Marie, Ann-Christin Jans & Helena Persson "The importance of education for the reallocation of labor: evidence from Swedish linked employer-employee data 1986–2002"

2007:15 Åslund Olof & Hans Grönqvist "Family size and child outcomes: Is there really no trade-off?"

2007:16 Hesselius Patrik & Malin Persson "Incentive and spill-over effects of supplementary sickness compensation"

2007:17 Engström Per & Patrik Hesselius "The information method – theory and application"

2007:18 Engström Per, Patrik Hesselius & Malin Persson "Excess use of Temporary Parental Benefit"

2007:19 Eriksson Stefan & Jonas Lagerström "Detecting discrimination in the hiring process: evidence from an Internet-based search channel"

2007:20 Agerström Jens, Rickard Carlsson & Dan-Olof Rooth "Ethnicity and obesity: evidence of implicit work performance stereotypes in Sweden"

2007:21 Uusitalo Roope & Jouko Verho "The effect of unemployment benefits on re-employment rates: evidence from the Finnish UI-benefit reform"

2007:22 Edmark Karin "Strategic competition in Swedish local spending on childcare, schooling and care for the elderly"

2007:23 Valentin Kvist Ann & Jan-Eric Gustafsson "The relation between fluid intelligence and the general factor as a function of cultural background: a test of Cattell's investment theory"

2007:24 Lindahl Erica "Comparing teachers' assessments and national test results – evidence from Sweden"

2007:25 Lindahl Erica "Gender and ethnic interactions among teachers and students – evidence from Sweden"

Dissertation Series

2007:1 Lundin Martin "The conditions for multi-level governance: implementation, politics and cooperation in Swedish active labor market policy"

2006:1 Hägglund Pathric "Natural and classical experiments in Swedish labour market policy"

2006:2 Savvidou Eleni "Technology, human capital and labor demand"

2006:3 Söderström Martin “Evaluating institutional changes in education and wage policy”

2006:4 Lagerström Jonas “Discrimination, sickness absence, and labor market policy”

2006:5 Johansson Kerstin “ Empirical essays on labor-force participation, matching, and trade”