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DISCUSSION PAPER

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Katharina Michaelowa

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HWWA DISCUSSION PAPER

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Abstract

Low teacher motivation and its detrimental effect on student achievement are central problems of many education systems in Africa. Using standardized data for student achievement in Burkina Faso, Cameroon, Côte d'Ivoire, Madagascar and Senegal, this paper analyzes the empirical links between various policy measures, teacher job satisfaction and primary education outcomes. It appears that there is only very limited evidence for the effectiveness of intensively debated and costly measures such as increasing teachers salaries, reducing class size, and increasing academic qualification requirements. Other, more simple measures such as improved equipment with textbooks are both more effective and less costly.

It also appears that teacher job satisfaction and education quality are not necessarily complementary objectives. Especially those measures ensuring control and incentive related working conditions for teachers, significantly increase student achievement while reducing teacher job satisfaction. In addition, teachers' academic qualification beyond the "baccalauréat", while beneficial for students' learning, tends to lead to a mismatch between teachers' expectations and professional realities, and thereby reduces teachers' job satisfaction.

JEL classification: I21, O15, O20

Keywords: teacher job satisfaction, student achievement, Africa

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1. Introduction

The role of teachers is crucial for the transfer of knowledge in schools. At the same time, teachers' remuneration is the biggest cost factor in educational finance. In most countries, developing and industrialized alike, teachers' salaries account for between half and three fourth of current education expenditure. In some African countries, their part rises up to 90% (World Bank 2001). Given the magnitude of the financial investment involved, it is extremely important to know whether these funds are used efficiently.

In Africa, a major political topic in this context is how to resolve the problem of low teacher motivation and its detrimental effect on student achievement. The literature is full of apparently obvious policy recommendations, in particular to rise teachers' salaries and to reduce class size (see e.g. UNICEF 1999, p. 39, AfDB 1998, p. 197, Maclure 1997, p. 52, N'guilé 2000, Chivore 1988). However, in-depth analysis is rare and generally concentrates on the aspect of job satisfaction alone. The link to education quality has been difficult to establish so far, since suitable data on student achievement were missing until the late 1990s.

This paper attempts an initial empirical analysis for the francophone, sub-Saharan Africa based on the exceptionally rich database of the "Program on the Analysis of Education Systems" (PASEC) managed under the authority of the conference of francophone education ministers (CONFEMEN).¹ Three questions will be addressed:

- What are the factors determining teachers' job satisfaction?
- How does teachers' job satisfaction translate into learning outcomes?
- Which cost efficient measures could be suggested in order to increase both teachers' job satisfaction and education quality?

The paper is structured as follows: Section 2 provides a discussion of the PASEC dataset and its suitability for the analysis of teachers' motivation and education quality.

¹ Original French names: PASEC: Programme d'Analyse des Systèmes Educatifs des Pays de la CONFEMEN; CONFEMEN: Conférence des Ministres de l'Éducation des Pays ayant le Français en Partage. Data and first analytical reports are available on CD-Rom from the CONFEMEN (CONFEMEN 1999). If interested please contact the managing team at pasec@sentoo.sn.

Section 3 describes the actual state of teachers' job satisfaction based on different sources and variables. Sections 4 to 6 econometrically address the analytical questions raised above, and section 7 concludes.

2. The PASEC Dataset

To evaluate education quality, the most obvious indicator is learning achievement. Moreover, to analyze its determinants, background information is needed on students, teachers and schools. For the analysis undertaken here, information on teachers is particularly relevant. Most importantly, the data must include some information to draw conclusions about teachers' job satisfaction.

The PASEC dataset does fulfill these requirements. The data are derived from a stratified random sample of classrooms at different grade levels of primary education in several sub-Saharan African countries. In order to maximize the available number of observations, this study jointly uses the data for Burkina Faso, Cameroon, Côte d'Ivoire, Madagascar and Senegal for which internationally comparable information is available. Between 1995 and 1998 standardized tests in math and French were administered in primary schools of all five countries together with a collection of information on the students' socio-economic background and school variables that were collected using both teacher and director questionnaires. Concerning Cameroon, it should be noted that the country runs two parallel education systems, one in English and one in French. Only the francophone system is considered here.

Among the datasets providing internationally comparable data on student achievement and background variables PASEC has the advantage to systematically include pre-tests at the beginning of the academic year. This is not the case for the few other standardized surveys for developing countries, and not even for the most well-known international surveys covering industrialized countries such as TIMSS or PISA.² However, only the correction for results at pre-tests allows for a precise acknowledgement of learning within a specific year. Since teachers often change from one year to the next, this is crucial for the outcome oriented evaluation of all teacher related variables - including job satisfaction.

Since there is strong evidence that the effects of various variables on student learning is not independent of the class level considered (Bernard 1999), information of different grades should not be pooled. To simplify the analysis, this study focuses on a single

² Similar surveys in the developing world were initiated for a couple of English speaking sub-Saharan African countries by the Southern Africa Consortium for Monitoring Educational Quality (SACMEQ) and for Latin-American countries by the "Laboratory Project" of UNESCO-Santiago. For an overview and initial results see Ross (1998) and UNESCO-Santiago (1998) respectively. For information on TIMSS and PISA see IEA (2001) and OECD (2001).

grade level. While the full dataset is available for both second and fifth grade students and teachers, only information concerning the fifth grade was included into this analysis. This is the last grade of primary education in Madagascar, and the second highest grade in the other four countries covered by the sample. For this grade level, the PASEC database contains information on learning achievement for between 2000 and 2500 children in about 100 primary schools in each of the five countries. The items selected for the tests were discussed among education specialists and members of the different education ministries in order to equally reflect the curricula in all countries. For all tests Cronbach's alpha, the numerical coefficient of reliability, is between 78% and 84%. This shows a good inter-item consistency and a high probability that carrying out the same test again would lead to very similar results. A detailed description of the data is provided by CONFEMEN (1999).

It should be added that there are also a few shortcomings of the PASEC dataset, in particular concerning the high number of missing values for a considerable number of variables both at student and at school level. In many regressions, this problem reduces the number of observations to 60%-70% of the total number of students and schools in the sample. Unfortunately, the problem is particularly strong for some of the teacher variables most relevant here. A second factor limiting the suitability of the dataset for the analysis of teachers' motivation is that no information is available on individual teachers' salaries. In order to get a broad idea about the interrelation of job satisfaction and salaries, aggregated country data will have to fill the gap.

3. Evidence on Teachers' Job Satisfaction

It seems important to first clarify the definitions. The definition of job satisfaction used here is very pragmatic. It simply indicates whether the teachers do or do not like their job. No specific distinction is made between satisfaction and dissatisfaction as models such as Herzberg's (1968) famous two-factor analysis would suggest. Anyway, the literature does not offer a uniform theoretical concept of job satisfaction (see e.g. Evans 1997, for discussion). Wittmann (2002) and Garrett (1999) provide interesting literature reviews of job satisfaction and motivation theory with respect to teachers and schools. In this study, however, analysis is purely empirical and relies on data that permit an interesting, but only simple approximation of job satisfaction.

It should also be noted that job satisfaction is not the same as job motivation. These terms are related but may not be used as synonyms. While job satisfaction gives an indication of teachers' well-being induced by the job, motivation is defined as their willingness, drive or desire to engage in good teaching. Whether job satisfaction does or does not translate into motivation, is a question that will be subject to analysis in section 5.

How is job satisfaction reflected in the data? The most important indication is given by the teachers' own answers to the question which profession they would choose if they had to choose once again. Teachers had to opt for either the medical, the judicial, the agricultural, the technical, the financial, the commercial, or again the teaching profession. Regrouping the answers a binary variable (JOBSATIS) can be created indicating whether the teacher would choose his profession again (JOBSATIS=1), or whether he wouldn't (JOBSATIS=0).

Two other variables can be used to complement and countercheck the relevance of this variable. The first is teachers' desire to change the school if they had the occasion. Their answer is again captured by a binary variable (CHANGE) that takes the value 1 if they would, and the value 0 if they wouldn't like to change the school. The second variable captures the number of working days teachers were absent during the month before the survey (ABSENCE). Unfortunately, just as for the other two variables, the information is collected only by self reporting which probably led to some understatement whenever respondents did not trust the anonymity of the questionnaire. The fear to reveal the truth also appears to have resulted in a high number of missing values for this particular variable. Moreover, teachers apparently did not always understand the question since

some figures exceed the maximum number of working days in a month. In these cases, the value of the variable was adjusted to ABSENCE=25 for the purpose of this study.

Assuming that, on average, teachers satisfied with their work would (i) choose their profession again, (ii) be happy to stay in the same school, and (iii) will be absent less often than other teachers, Table 1 provides an overall impression of teacher job satisfaction for the five countries in the sample.

Overall, more than 50% of fifth grade teachers seem to prefer teaching to any other profession, and over 40% like their schools and do not want to change. The situation therefore does not correspond to the desperate picture of a generally demoralized teaching profession suggested by many African sources (for an overview, see Maclure 1997, ch. 4). At the same time, as almost half of the teachers would prefer another job, and almost 60% would like to change schools, there is definitely much room for improvements.

Table 1: Indicators of Teacher Job Satisfaction in Francophone Africa, 1995-1998

	Burkina Faso	Cameroon	Côte d'Ivoire	Madagascar	Senegal	Total
Share of teachers who would choose the same profession again (JOBSATIS=1), in %	56.7 (4.9)	55.8 (5.1)	45.8 (4.6)	65.5 (4.4)	40.6 (5.0)	53.2 (2.2)
Share of teachers who would like to change schools (CHANGE=1), in %	43.3 (4.9)	38.9 (5.0)	54.2 (4.6)	23.5 (3.9)	61.5 (5.0)	43.8 (2.2)
Teachers' average absence (ABSENCE), in working days/month	2.24 (0.38)	1.80 (0.39)	1.28 (0.16)	2.50 (0.42)	4.72 (0.54)	2.39 (0.18)

Annotation: standard errors in parenthesis.

Moreover, absenteeism appears to be a serious problem. PASEC data indicate that teachers, on average, miss their classes during half a week per month. Assuming that teachers rather understate than overstate their absence, and that they tend to deny reporting when their absenteeism is particularly pronounced, the true situation can be supposed to be even worse.

However, Table 1 also shows that there are significant differences between individual countries. The situation is clearly the worst in Senegal where the average teacher is absent about twice as much as in all other countries. The other indicators point into the same direction: More than 60% of teachers would like to change schools if they had the

occasion, and only slightly above 40% would choose the teaching profession again. In both cases, the figure indicates a lower job satisfaction than in any other country, and significantly differs from the country average.

Côte d’Ivoire also shows a relatively low level of job satisfaction. While the share of teachers who would again choose the teaching profession is considerably higher, and the share of teachers willing to change schools considerably lower than in Senegal, these differences are not significant at a level of 5%. Only with respect to its comparatively low absence rates, Côte d’Ivoire shows a significantly better result than Senegal.

At the other end of the scale, there is Madagascar, with about average absence rates but an exceptionally strong preference for both teachers’ current profession and institution. Over 65% would choose the same profession again, and only 23.5% would like to change schools. Burkina Faso and Cameroon find their positions in between.

It is now interesting to devote some attention to the relationship between the three indicators. The presentation of country means has already suggested a significant negative correlation between the preference for the teaching profession and the desire to change schools. If JOBSATIS correctly reflects teachers’ general liking of their job, one should indeed expect them to also show a certain appreciation of their place of work. Similarly, if JOBSATIS is correctly specified, one should expect this variable to be negatively related to teachers’ absence rates. However, the latter relationship was less clear in the above country comparison, and it does not turn out to be significant either when calculating the chi-square test based on the contingency table for these variables. Contingency coefficients are presented in Table 2. For this purpose, the variable ABSENCE was temporarily recoded into a discrete variable with three categories (0, 1-2, and 3 or more days of absence). Contingency coefficients appeared to be reasonably robust with respect to alternative classifications of the data.

Table 2: Bivariate Contingency Coefficients

	JOBSATIS	CHANGE	ABSENCE
JOBSATIS		0.172***	0.071
CHANGE	0.172***	1	0.111*
ABSENCE	0.071	0.111*	1

Annotation: ***significant at $\alpha=0.01$, *significant at $\alpha=0.10$.

One major reason for the missing link between ABSENCE and JOBSATIS might be that the relation between both variables is hidden through the influence of additional variables. It might also be the case that ABSENCE stands for a different dimension of job satisfaction and must therefore be considered as a fully complementary measure. Finally, it could be that the missing link between both variables is a consequence of (partly country specific) factors that are independent of the teachers' positive or negative feelings about their job. Concerning the variable CHANGE, to a certain extent, similar questions arise, even though the correlation with JOBSATIS is highly significant. These questions will all be discussed in the next section that attempts to analyze the determinants of teacher job satisfaction.

4. Determinants of Teacher Job Satisfaction

In order to derive the determinants of teacher job satisfaction, the three indicators presented above will be regressed on five groups of variables:

- Variables describing the classroom environment and school facilities (class size and structure, students' initial performance, availability of books, electricity, tables, blackboards and other equipment, proximity of the next city...)
- Variables describing the teachers own characteristics (gender, family status, job experience, qualification...)
- Variables describing the teacher's contract conditions (civil servant or private employee, job perspectives, additional work apart from teaching...)
- Variables describing the human relations, teacher's supervision and responsibilities (exchange with colleagues, meetings with the director, control by parents and school inspectors...)
- County dummies to capture country specific differences.

Finally, JOBSATIS will be considered as an explanatory variable for both CHANGE and ABSENCE so as to gain some further insight into the relationship between these variables.

Generally, the explanatory variables selected here reflect relevant predictors of teacher job satisfaction in the literature, notably based on situational models of job satisfaction (see e.g. Hoy and Miskel 1996). It is expected that teacher job satisfaction will be enhanced by a well equipped school environment, adequate training, and contract conditions ensuring, in particular, long term job prospects, security and a decent salary. Moreover, teacher job satisfaction will probably benefit from a positive exchange with colleagues, the director, and students' parents, but it might suffer from pressure via control. Other variables, such as teachers' family status and gender, are included as control variables.

In order to test these hypotheses, a probit model will be estimated for the two binary dependent variables JOBSATIS and CHANGE. For the variable ABSENCE, a tobit regression model is used so as to capture left censoring at 0 and right censoring at 25 (the minimum and the maximum of working days a teacher can be absent within a month).

Table 3 presents the results. For each dependent variable, two regressions are displayed. The first includes a high number of explanatory variables while the second is limited to those with the highest explanatory power. In this way, the table offers both, a general insight into the range of variables tested and an overview over the optimal model. Detailed variable descriptions are provided in the annex.

4.1 *Classroom Environment*

Variables to capture the influence of the classroom environment include students' average knowledge level measured at the beginning of the school year (RATE1 and RATESN1³), class size (STUDNUMB), and specific aspects of organization such as several grade levels within a single class (MULTGRADE) and different classes using the same classroom at different times of the day – generally with the same teacher (DOUBLSHIFT). Classroom equipment is measured by an index combining very basic items such as a blackboard, chalk, benches, tables, etc. (BASEQUIP), the availability of textbooks for both math and French (BOOKS), of teacher guide books (GUIDE), and of electricity (ELECTR). It is also considered whether the school is situated in an urban area or at least close to it, or whether it is far away from any city (TOWNFAR).

It appears that teachers are generally less satisfied with their profession when they have to teach classes with a high number of students and when they are posted in isolated rural areas far away from the next city. At the same time, school equipment plays a significant role, in particular concerning prestigious items such as electricity. These variables also influence the teachers' desire to change schools. Contrary to basic items such as chalk, blackboard etc., the availability of books as one of the most important student learning materials also plays a significant role here. Moreover, the desire to change the school is influenced by the students' initial knowledge level, i.e. teachers prefer to stay at the same place when they have well performing students there.

The factors influencing teachers' absence from school seem to be different. Here, only the exceptional modes of class organization, i.e. both the multi-grade and the double-shift system, appear to exert a significant influence. Both systems lead to teachers missing much more often than they do in other systems.

³ For Senegal the separate variable RATESN1 had to be introduced since in this country, the pre-test differed from the standardized version of the other four countries.

Table 3: Determinants of Teacher Job Satisfaction

Dependent Variable:	JOBSATIS		CHANGE		ABSENCE	
Method:	ML-Probit	ML-Probit	ML-Probit	ML-Probit	ML-Tobit	ML-Tobit
N	403	504	403	497	353	384
Expl. Variables	Coef. Regr. 1	Coef. Regr. 2	Coef. Regr. 3	Coef. Regr. 4	Coef. Regr. 5	Coef. Regr. 6
C	1.3424 **	1.3737 ***	0.6119	0.7888 **	2.7952	1.2297
<i>Classroom environment</i>						
RATE1	0.3371		-1.3170	-1.4602 **	-3.3817	
RATESN1	1.8411		1.6571	1.9988	-11.2712	
STUDNUMB	-0.0065 *	-0.0059 **	-0.0044	-0.0044	-0.0071	
MULTGRAD	0.1406		0.2252		2.5971 **	2.7065 ***
DOUBLES SHIFT	-0.1494		0.1088		0.3434	1.7682 *
BASEQUIP	-0.0006		0.1821		-0.5981	
BOOKS	0.1032		-0.6293 **		0.5317	
GUIDE	0.0880		0.1247		0.0912	
ELECTR	0.3681 **	0.3238 **	-0.4378 **	-0.3139 **	0.4240	
TOWNFAR	-0.5802 **	-0.3656 *	0.3605	0.4159 *	-0.9554	
<i>Teacher characteristics</i>						
GENDER	-0.2897 *	-0.1789	-0.1894		0.0014	
ALONE	-0.3628 *	-0.3826 **	0.4013 *	0.4029 **	-0.2933	
FRENCH	0.0799		-0.0271		0.1092	
LANGLOC	-0.0947		-0.0184		0.1391	
EXPER	-0.0108		-0.0069		-0.0654	-0.0328
BACPLUS	-0.5039 ***	-0.4569 ***	0.2900 *	0.2816 **	-0.2800	
DIPLPED	-0.4074	-0.3840 *	0.0351		0.2931	
NOSEM	-0.1278		0.1787		-1.1886	-1.4180 **
<i>Contract conditions</i>						
VOLUNT	-0.1281		0.7959 ***	0.6411 ***	-2.6728 **	-3.1562 ***
INTERIMDIR	-0.4684 *	-0.4404 *	0.2414		-1.3166	-1.2945
AFAVISIT	0.4267 *	0.3388 *	0.0074		0.2282	
AGETPAY	-0.2237	-0.1011	0.0159		0.7002	0.7405
ASECJOB	0.2177		0.1777		2.2095 **	
TUITION	0.1247		0.1650		0.6623	
ACTIVITY	0.0649		-0.0276		1.6130 **	1.7038 ***
UNION	0.3811 **	0.1065	0.1161		-1.0589	-0.5271
PILOTPRG	-0.0314		0.1224		-0.3240	
<i>Exchange, support and control</i>						
EXCHANGE	-0.1656		0.1285		-0.1612	
MEET	0.0094		-0.0090		0.1723	
IINSPECT	-0.1914		0.5105 **	0.4767 ***	-1.0154	-1.1612 *
IADVICE	0.1558		-0.0956		-0.7706	-0.5946
IMEETPAR	0.3299		-0.2257		1.2641	1.3972 *
PTORGA	-0.0062		0.2029	0.2016 *	-0.3306	
ACTIVPAR	-0.0350		-0.4309 ***	-0.4438 ***	0.2337	
ASSOC	-0.0112		-0.0784		0.5428	0.2692
<i>Overall job satisfaction</i>						
JOBSATIS			-0.1331	-0.3027 **	-1.0953 *	-0.9967 *
<i>Country dummies</i>						
CI	-0.6929 **	-0.6570 ***	0.5953 *	0.1794	-1.7338	-1.6692
CM	-0.3578	-0.3830	-0.0544	-0.2398	-1.7708	-1.8479 *
MD	-0.2103	-0.2331	-0.3849	-0.6262 ***	-0.6743	-0.5572
SN	-0.6074	-0.4814 **	-0.6985	-1.0166	5.3824 *	3.5481 ***
Log likelihood	-246.85	-320.709	-226.66	-287.25	-735.23	-808.05
Restr. log likelihood	-278.43	-348.775	-276.59	-340.98		
LR statistic	63.17 (39df)	56.13 (15df)	99.87 (40df)	107.47 (16df)	R ² =0.21	R ² =0.19
Probabilitiy (LR stat)	0.01	1.15E-06	5.00E-07	1.33E-15	R ² (adj.)=0.10	R ² (adj.)=0.15
Obs. with Dep=0	188	240	225	278	Censored obs. 133	Censored obs. 144
Obs. with Dep=1	215	264	178	219	Uncens. obs. 220	Uncens. obs. 240

Annotation: *** significant at $\alpha=0.01$, ** significant at $\alpha=0.05$, * significant at $\alpha=0.10$.

4.2 *Teacher Characteristics*

Regarding teachers' own characteristics, Table 3 shows a similar divide between ABSENCE and the other two dependent variables. Absence appears to be significantly less prevalent only for teachers who do not attend any continuous training seminars (NOSEM) – probably implying that the attendance of these seminars generally takes place during school hours.

CHANGE and JOBSATIS are both influenced by the teachers' educational attainment. Contrary to expectations, satisfaction with both profession and working place is reduced, when teachers' attainment is high. This does not necessarily exclude that, as the famous model by Hackman and Oldham (1980) and other empirical studies (e.g. Ma 1999) would suggest, knowledge of the job and teaching competence are relevant for teacher job satisfaction. However, it seems that once teachers hold the high-school degree "baccalauréat" (BACPLUS), they face a mismatch between their professional expectations and work realities. Potential positive effects via facilitated teaching and increased self-confidence appear to be more than counterbalanced by this negative effect. The effect is the same, but less pronounced, if they hold a pedagogical degree (DIPLPED). Similar results were found by Sim (1990) and Ho (1985) for secondary school teachers in Singapore.

Language knowledge (LANGLOC and FRENCH) does not seem to play a significant role. Neither does the level of professional experience (EXPER). The two control variables indicating teachers' sex (GENDER) and their family status (ALONE), however, do seem to be relevant. It is little surprising to note that teachers staying alone without family tend to be more mobile than others. But at the same time, they display a generally lower level of job satisfaction. Moreover, on average, men seem to be less satisfied with their teaching job than women are. Similar results for other world regions were reported by Mwamwenda (1997), Ma (1999), Kremer-Hayon and Goldstein (1990), and Thompson, McNamara and Hoyle (1997).

4.3 *Contract Conditions*

With respect to contract conditions, different groups of teachers can be distinguished. One particularly interesting group most highly represented in the Cameroonian sample are the so called “voluntary” teachers (VOLUNT). These teachers are no civil servants, they work on private contracts of various duration and may be employed and paid by the school or even directly by their students’ parents. This implies that they generally have less job security, and that, at the same time, they are more directly responsible to their clients. While there is no obvious effect on JOBSATIS, this group of teachers shows an extremely strong desire to change schools – probably related to the hope to be employed on a more secure government position in another school. At the same time, absence rates are significantly lower as compared to other teachers. Coefficients can be interpreted as an indication that, on average, voluntary teachers miss about 1.5 to 2 working days less per month.⁴ Since they would apparently prefer to work under different contract conditions, this reduced time of absence does not seem to be the effect of high job satisfaction, but rather the effect of direct control, personal responsibility and the fear of consequences for further employment.

The situation of voluntary teachers can be contrasted with the one of “interim directors” (INTERIMDIR), the second highest status group among primary teachers. This group of teachers, most frequently represented in the sample of Burkina Faso, enjoys a stable civil servants’ employment. Nevertheless, they appear to be generally most disappointed of their job, since – as indicated by the significant and strongly negative coefficient - hardly any member of this group would choose the same profession again. The following variables indicate some features of teachers’ work realities from the directors’ point of view. The latter were asked to indicate the three major reasons for teacher absenteeism. Teachers in schools where directors pointed out family visits (AFAVISIT) as a major problem, appear to be clearly more satisfied with their job. Apparently they enjoy this freedom and lack of control irrespective of the impact this may have on students’ learning. The necessity to collect salaries from far away places (AGETPAY), indicated by a large number of directors in particular in Senegal, does not show any significant effect, however. And only the directors’ perception that teachers presence suffers from their second jobs (ASECJOB) is reflected in a significant and highly positive coefficient in the regressions of ABSENCE indicating that the rate of absence is indeed considerably higher for this group of teachers.

⁴ This is a crude approximation based on the fact that the marginal effect corresponds to the coefficient of the tobit regression multiplied by the probability of an observation between the two censoring limits. For more details, see Greene (1993, pp. 694f., in particular footnote 19).

The latter result is confirmed by the teachers' own statements about their additional occupations. They are captured here by the variable TUITION indicating whether the teacher gives private classes after school, and the variable ACTIVITY including any other kind of activity besides teaching. While the former shows no significant effect on any of the depending variables, the latter leads to significantly increased rates of absence. Since this is not reflected by any apparent effect on the variable JOBSATIS, it might not necessarily indicate a low satisfaction with the teaching profession, but rather the desire or necessity to increase the family income, and the lack of control if this is done during class hours.

Another factor that does play a significant and positive role with respect to teachers' overall valuation of their profession is union membership (UNION). While this might indicate the support an individual teacher expects to get from a well organized group of peers, it might also indicate something about the perceived (political) strength of the teaching profession as a whole, thereby positively influencing the individual teacher's self-esteem.

Participation of the school in pilot programs or twinning with schools from abroad (PILOTPRG) does not seem to have any relevant effect on teachers' job satisfaction.

4.4 Exchange, Support and Control

The final set of explanatory variables includes information on teachers' professional working conditions as members of the school and town or village community. As opposed to other studies where communication among teachers and with principals appeared to have a strongly positive impact on teacher job satisfaction (Verdugo et al. 1997, Whaley and Hegstrom 1992, Kloep and Tarifa 1994), this effect could not be detected based on the indicators available here. Neither exchange among teachers (EXCHANGE) nor the number of regular meetings with the principal and all other colleagues (MEET), does show a significant effect on any of the dependent variables. The role of the school inspector, however, appears to be very important. Teachers do not seem to appreciate when he comes for proper inspection, i.e. for control of individual teachers' classroom practices (IINSPECT). As indicated by the strongly positive and highly significant effect on the variable CHANGE, teachers prefer to go to other schools to avoid this control. At the same time, on average, wherever this control takes place, absence rates per month are reduced by about one day, i.e. by 30-50% of

the average monthly absenteeism. When inspectors come only to give advice (IADVICE), this does not show any significant effect. And when they come to meet students' parents (IMEETPAR), this actually seems to increase teachers' days missing at work - possibly because inspectors will speak to parents and children so that neither teachers nor children do attend their classes.

Contact to parents does seem to be of a certain relevance as well. However, surprisingly, the role of active parent-teacher organizations (PTORGA) is apparently seen in a rather negative light by the teachers concerned. Where they exist, teachers tend to have a considerably higher desire to change schools. This might again indicate their propensity to avoid control. At the same time, teachers are much less willing to change their schools when parents are active in a more direct sense (ACTIVPAR) providing manpower or finance for additional equipment or other improvements on teachers' request.

The teachers' involvement in various kinds of social, local or other organizations (ASSOC) which might ease their integration into the local community and the contact with parents, does not show any significant effect.

4.5 Interrelation of Dependent Variables

Finally, looking at the interrelation of the three indicators of job satisfaction, it can be noted that JOBSATIS does indeed significantly influence both CHANGE and ABSENCE in the ways expected. While this was not clear from bivariate correlations in Table 2, once other factors are controlled for, the relationship becomes clear. This supports the role of JOBSATIS as the central indicator for job satisfaction. While it is apparent from the above discussion, that the three variables JOBSATIS, CHANGE and especially ABSENCE have certain differences in their determinants, these differences do not seem to arise from the coverage of different, complementary aspects of job satisfaction. They rather appear to be a result of other factors - unrelated to job satisfaction - that are also captured by the variables CHANGE and ABSENCE. With respect to the latter, this has become most obvious looking at factors that imply any sort of control: While the lack of control is generally appreciated by teachers, it apparently leads to higher rates of absenteeism.

4.6 *Other Determinants, in Particular: Financial Incentives*

Unfortunately, despite the richness of the PASEC dataset, a considerable number of potentially relevant factors could not be tested in the above regressions. Teachers' autonomy and workload, for instance, are frequently considered in other studies (Perry, Chapman and Snyder 1995, pp. 118ff., Abu-Saad and Hendrix 1995, p. 149, Barnabé and Burns 1994, p. 179). Moreover, one of the most intensively debated and financially relevant variables omitted here is the question of teachers' salaries or financial incentives in general.

However, some of these effects can be captured by country dummy variables. In fact, within individual countries, salaries are generally determined by the teachers' educational attainment, job experience and teaching status (e.g. voluntary teachers, ordinary civil servants, interim directors or principals). This type of variables has already been taken into account in the above regressions. The reminder should be general cross-country differences in the level of average teacher salaries, and in the way these salaries evolved over time.

Table 4 shows that there are indeed considerable cross-country differences between the salary levels (related to the national GDP per capita) and between the ways these salaries evolved during the 1980s. While more recent data were not available, individual information indicates that the relative position of individual countries did not change much at the beginning of the 1990s. Cameroon is clearly the country with both the lowest level and the most serious decrease of teacher salaries during this period. The decrease was very strong in Burkina Faso and Senegal as well, but levels still remained comparatively high. In Madagascar, the levels were low, but the decrease remained moderate. In Côte d'Ivoire finally, the decrease remained moderate despite a relatively high average salary level.

Table 4: Job Satisfaction and Financial Incentives

	Burkina Faso	Cameroon	Côte d'Ivoire	Madagascar	Senegal
JOBSATIS 1995/96 ¹	56.7%	55.8%	45.8%	65.5%	40.6%
Primary teacher average salary / GDP per capita (relative salary), 1990	8.4	2.6	6.2	3.0	7.2
Relative salary development 1980-1990	-33%	-38%	-18%	-12%	-26%
<i>For comparison</i>					
Development of real manufacturing wages 1980-1990 ²	+3.0%	-10.2%	+5.3%
1990-1995 ³	..	-41.4%	-23.7%	..	-13.9%

¹ For Madagascar, the year is 1997/98.

² For Burkina Faso, the wage is for a typical laborer, not necessarily in manufacturing, and the period is 1985-91.

³ For Côte d'Ivoire, the wage is for a typical laborer, not necessarily in manufacturing, and the period is 1992-94.

Source: CONFEMEN (1999), Mingat and Suchaut (2000, Annex), ILO (2002, pp. 506f. and 550).

If salary levels or their change over time did have a considerable impact on teacher job satisfaction, this should be reflected in a significantly negative country dummy for Cameroon (CM) in regressions 1 and 2, and possibly a positive dummy in regressions 5 and 6. The opposite should be true for Côte d'Ivoire, i.e. the country dummy CI should have a positive and significant coefficient in regressions 1 and 2. Dummies for Madagascar (MD) and Senegal (SN) should be somewhere in between, with Senegal coming close to Côte d'Ivoire.⁵ Looking at Table 3 it turns out that the country dummies do not reflect the salary structure at all. In fact, teachers in Côte d'Ivoire and Senegal, i.e. in those countries where teachers are financially relatively well off, seem to be even less satisfied with their situation than they are in other countries. A direct bivariate comparison between JOBSATIS, and salary levels and development, does not suggest the expected relationship either. In fact, the case of Madagascar clearly indicates that even very low salaries are compatible with relatively high job satisfaction.

Comparing the development of teacher salaries with the development of wages in the private sector may provide additional insights. In Senegal, for instance, where real manufacturing wages still rose throughout the 1980s and fell only moderately thereafter, the diverging development of public and private sector incomes could have provoked dissatisfaction among teachers. However, the argument is not consistent with all country cases. In Burkina Faso, the divergence between private and public sector wages is even stronger. Moreover, Côte d'Ivoire experienced an extreme decline in private sector wages during the early 1990s that should have put teachers into a relatively comfortable position. The country's below average teacher job satisfaction and its highly significant negative country dummies in regressions 1 and 2 thus remain unexplained.

⁵ There is no country dummy for Burkina Faso in order to avoid perfect multicollinearity. Burkina Faso thereby becomes the country of comparison.

All in all, while the data do not allow a final conclusion, the role of salaries does not seem to be as important as many people believe. Country dummies apparently reflect other, more predominant country specific effects. As argued by Pritchett and Filmer (1999, pp. 226ff.), the salary arguments might only be so prominent in the political discourse, because teachers themselves exert considerable power as a generally well organized pressure group. In reality, they probably do not compare each other much with their colleagues across the border, and it seems more relevant which kind of specific incentive systems are at work within the individual countries. This refers back to the different use of specific forms of contracts, in particular the contract of voluntary teachers, and to the right mix of the responsibilities, freedom and control mechanisms discussed above.

5. Job Satisfaction and Learning Outcomes

Teacher job satisfaction can of course be regarded as an objective in itself. It is often looked upon, however, as a means to promote good teaching and thus high education quality. In order to analyze this second link, other studies generally needed to recur to problematic indirect indicators. Perry, Chapman and Snyder (1995) for instance, use the observation of differences in teaching methods that are assumed to be correlated to learning outcomes. As described in section 2, this is where the PASEC dataset has its comparative advantage since it provides direct information on student achievement on an internationally comparative basis both at the beginning and the end of the academic year. In order to test the link between teacher job satisfaction and education quality, student achievement at the end of the year (RATE2_S) can simply be regressed on JOBSATIS controlling for students' initial knowledge (RATE1_S and RATESN1_S) and other relevant determinants of student learning.

Computing the regression model, it has to be taken into account that information is available at two levels:

- (i) Level 1 - student level: achievement data, family characteristics etc., and
- (ii) Level 2 – school or class level⁶: teacher and school characteristics, classroom equipment etc.

In this setting, school level observations for different students within the same class are obviously not independent of each other. The hierarchical data structure thus leads to a violation of usual assumptions for OLS regressions and to downward biased OLS estimates for standard errors. However, the correct error structure can be captured using a simple two-level hierarchical linear model (HLM).⁷

For $i=1, \dots, N_j$ students in $j=1, \dots, J$ classes, this model can be written as:

$$\text{Level 1 (students): } y_{ij} = Z_{ij} \alpha + X_{ij} \beta_j + r_{ij}$$

$$\text{Level 2 (schools): } \beta_j = B_j \rho + u_j$$

$$\text{Reduced form: } y_{ij} = Z_{ij} \alpha + X_{ij} B_j \rho + X_{ij} u_j + r_{ij} \quad ,$$

⁶ School and class levels are identical here, since only one class is considered in each school.

⁷ The structure of the model actually represents an extension of a random effects panel model, although no time series data are involved here. For more general information on HLM see Bryk and Raudenbush (1992) and Goldstein (1999). For a more complex application with cross level effects and three hierarchical levels equally based on PASEC data, see Michaelowa (2001a).

where y_{ij} is the dependent variable, Z_{ij} are explanatory level 1 variables whose influence is independent of school level variables, and B_j are explanatory variables at level 2. The corresponding fixed coefficients are α and ρ , and r_{ij} and u_j are residuals of levels 1 and 2 respectively. The interesting feature is the link between both levels provided by the random coefficients β_j that are introduced as coefficients for student level data X_{ij} but explained by information available at school level. In the specification chosen here, X_{ij} will simply represent a constant term whose coefficient is allowed to vary across schools.

From the reduced form, it becomes obvious that the overall error term is $X_{ij} u_j + r_{ij}$ whose covariance is inevitably different from zero for two students of the same school, even if the individual error terms are assumed to fulfill the usual conditions to have zero mean and to be uncorrelated among each other and across different i or j .

Estimating the reduced form of the model using ML techniques and the expectation-maximization (EM) algorithm described in the technical annex of Bryk and Raudenbush (1992) leads to the results presented in Table 5. While a greater number of control variables was introduced in earlier regressions, regression 7 displayed here is restricted to those variables with a significant or close to significant influence at a level of 10%, and to the country dummies. Regression 8 differs from regression 7 by introducing two further variables for comparison with the discussion in the previous section. Again, all variables are explained in detail in the annex.

It appears that indeed, as expected, teacher job satisfaction does exert a positive and significant influence on student learning. Among the control variables, at student level, each child's initial knowledge (RATE1_S, RATESN1_S) plays the predominant role. Apart from that, children of higher age (AGEPLUS) and children having repeated one or several classes before reaching the fifth grade (REPEAT2) seem to be at a disadvantage. Conversely, French speaking students (FRENCH_S), and students equipped with radio and/or television (MEDIA) and books (LIBRARY) at home, tend to perform better. A discussion of results of other studies analyzing these and other student level determinants of educational outcomes can be found in Michaelowa (2000 and 2001a).

Here however, it seems more relevant to move quickly to level 2 variables, and this not simply for the purpose to evaluate their influence on student learning, but rather to

discuss this influence in relation to the influence of the same variables with respect to teachers' job satisfaction.

Indeed, it should be noted, that many of the variables already shown to be relevant for teachers' job satisfaction, also exert a direct influence on student achievement. Trying to join the objectives of teacher job satisfaction and education quality is thus equivalent to selecting those factors which positively influence both variables or at least positively influence one without negatively influencing the other. Looking at individual coefficients, the relative efficiency of these strategies can also be determined.

Table 5: Determinants of Student Achievement

Dependent variable	RATE2_S	RATE2_S
Method:	HLM (2 levels)	HLM (2 levels)
N (number of student level observations)	6664	6664
J (number of school level observations)	386	386
Explanatory variables at student level	Coefficients Regr. 7	Coefficients Regr. 8
C	(random coefficients ¹)	(random coefficients ¹)
RATE1_S	0.520***	0.520***
RATESN1_S	0.731***	0.713***
AGEPLUS	-0.013***	-0.013***
FRENCH_S	0.006*	0.005*
REPEAT2	-0.010***	-0.010***
MEDIA	0.006***	0.006***
LIBRARY	0.006**	0.006*
Explanatory variables at school level	Coefficients Regr. 7	Coefficients Regr. 8
JOBSATIS	0.017**	0.016**
VOLUNT	0.028*	0.026
INSPECT	0.027**	0.028**
TUITION		0.016
ACTIVITY		-0.004
EDUCATION	0.012***	0.012***
TRAINING	0.017***	0.017***
EXPER	0.006***	0.006***
EXPER2	-0.000**	-0.000**
LANGLOC	0.014	0.014
DOUBLES SHIFT	-0.025*	-0.024*
MULTGRAD	0.033*	0.033*
STUDNUMB	0.002***	0.002***
STUDNUMB2	-0.000***	-0.000***
BOOKS	0.030**	0.029**
TOWN	0.014	0.013
CI	-0.037*	-0.036**
CM	0.005	0.007
MD	0.001	0.002
SN	-0.079***	-0.080***
Overall fit of regression (as compared to the model empty at both levels simultaneously)		
R ² (student level)	0.37	0.37
R ² (school level)	0.52	0.52

Annotation: *** significant at $\alpha=0.01$, ** significant at $\alpha=0.05$, * significant at $\alpha=0.10$.

¹ Given their high number, individual school constants are not presented here.

6. Increasing Both Job Satisfaction and Education Quality

Trying to combine the objectives of teacher job satisfaction and student achievement, the easiest procedure seems to be to check – one by one – the coefficients of level 2 variables presented in Table 5 and to compare them with the results from section 4.

It appears that the status of voluntaries (VOLUNT) induces these teachers to perform relatively well. In regression 7, the coefficient is significant, and in regression 8 it is almost significant at the level of 10%. Regressions 5 and 6 also showed that voluntary teachers are absent from work considerably less often than other teachers. At the same time, regressions 3 and 4 provided some evidence of the fact, that teachers do not particularly appreciate this type of contract situation. In fact, it might be precisely the hope to reach a better and more secure position in the civil service that induce voluntary teachers to take their work very serious and to perform comparatively well. Apparently, with respect to the contract situation, there is thus a conflicting relation between the teachers' level of wellbeing and the control and incentive mechanisms to induce good teaching practices.

The situation is similar as far as inspections of classroom practices are concerned. As determinants of student achievement, no significant differences could be made out between various objectives of an inspector's visit, so that these visits are presented in a single variable INSPECT in regressions 7 and 8. It is clear, however, that the predominant objective of inspectors' visits are inspections which apparently have a performance enhancing, but strongly disliked control effect.

Private tuition (TUITION) and other activities (ACTIVITY) are often believed to be the major vehicle translating bad financial teaching conditions into bad teaching performance. UNICEF (1999, p. 39) underscores that low salaries force many primary school teachers in Africa into other activities to the detriment of teaching – as shown above by the effect of ACTIVITY on ABSENCE in regressions 5 and 6. The African Development Bank (AfDB 1998, p. 197) goes even further identifying low salaries as the factor the most harmful for the education system altogether and suggesting that teachers tend to reserve their pedagogical skills and material for the more highly remunerated private tuition in the afternoon. However, these effects which are included in regression 8 do not turn out to be significant here. As suggested in Michaelowa (2000), reasons might be that teachers following other activities are generally more dynamic, and that private tuition often benefits a teacher's own students – even though

this leads to a hidden additional cost of schooling which will be difficult to bear for many families.

In any case, it is actually a common feature of many African societies, that people have to follow different activities to earn their living, and teachers do not necessarily have to make an exception. If undue charges to students' families and absence from teaching is avoided through adequate control mechanisms, the salary level as such does not need to be a problem. This would be in line with the reasoning in section 4 where even low salaries such in the case of Madagascar were shown to be consistent with a relatively high level of teacher job satisfaction. In any case, this study does not provide evidence for an increase in teacher salaries as a means to simultaneously raise teacher job satisfaction and student achievement. Although referring to a different part of the world, this is consistent with Hanushek, Kain and Rivkin's (1999) finding that salaries are only weakly related to teacher mobility and student performance. Since increasing teachers' salaries is one of the most expensive educational policy measures one could think of, one should be very careful as long as no truly clear evidence is available.

Looking now at teachers' educational attainment (EDUCATION) and participation in training seminars (TRAINING), the results in Table 5 indicate a clearly positive impact on students' learning. Unfortunately, and opposite to what might have been expected, higher educational attainment appeared to have a negative, rather than positive influence on job satisfaction in regressions 1-4. It should be noted, however, that this negative relationship was shown with respect to only one specific level of education, the baccalauréat (BACPLUS). It is less pronounced (although still significant) if one uses the variable EDUCATION that acknowledges for gradually increasing levels of education from 6th grade onwards. This suggests that, while teachers with high educational attainment might be discouraged by their professional career perspectives, the negative relationship does not necessarily hold for very low attainment levels. In fact, extremely low levels of teachers' educational attainment might be equally discouraging due to the difficulties faced to competently carry out their job. In any case, if the intention is to improve both teachers' job satisfaction and student achievement, raising teachers' educational level beyond the baccalauréat does not seem to be a sensible policy measure. This is interesting to note since here again, this excludes one particularly costly policy measure given that higher educational attainment is generally accompanied by higher pay.

The effects of teachers' experience (EXPER, EXPER2) and their knowledge of the local language (LANGLOC) are of lesser interest here. Neither of the two variables did show any significant impact on job satisfaction. With respect to student achievement, the positive coefficient of LANGLOC remains slightly below the 10% level of significance, too. Increasing job experience initially fosters student achievement, but the positive effect fades out after some time and then even becomes negative. In any case, EXPER is a mere control variable that cannot be used for policy making.

With respect to policy making, it is very interesting, however, to consider the variables of class management (DOUBLESIFT and MULTGRAD) as well as class size (STUDNUMB, STUDNUMB2). In regressions 1 and 2, a big class size was shown to have a clearly negative impact on teacher job satisfaction. Just as in the case of salaries, it is often assumed that reducing class size might be a perfect tool to improve both teacher job satisfaction and education quality. However, the link between class size and educational outcomes is less clear than it might appear. Hanushek (1998) provides an interesting overview over a high number of studies with very mixed results. Michaelowa (2001b) provides details for the relationship in each of the five countries considered here. Overall, it appears from regressions 7 and 8 that the impact follows a quadratic function. Based on the regression estimates, it can be calculated that – at least at prevailing teaching methods - a negative impact of increased student numbers can be felt only from about 65 students onwards. Even then, the impact remains relatively moderate and does not increase very fast. While the effect of reduced student numbers is thus strongly relevant for teachers' well being, its impact on student learning is less obvious by far.

With respect to the effect of the double-shift class structure, however, there finally appears to be a correspondence between both, a negative effect on teachers' job satisfaction, and a negative effect on education quality. Double-shift classes often put teachers under considerable strain since they generally have to deal with two consecutive groups of students, without much time for preparation in between. At the same time, students of each group often spend a reduced time period in school, even if this is not always intended by educational planners. A further problem might be that timings of at least one group are often problematic with respect to climatic influences (e.g. heat in the early afternoon) or life rhythms (e.g. having to get up very early without

breakfast).⁸ In any case, this system apparently leads to considerably reduced student achievement and an increased absence of teachers from their work.

Since double-shift classes are generally introduced to cope with high student numbers, it is interesting to compare the effect of this variable with the impact of increased class size. Given the parameter estimates of regressions 7 and 8, it can be calculated that only at a class size of over 100 students, it makes sense to cut the class into two groups.⁹ This reasoning is based merely on grounds of educational quality and does not even take into account that double-shift management obviously implies additional cost. Even if no extra teacher is employed, the existing teacher has to be paid for additional working hours, and often at expensive overtime rates.

With respect to teacher job satisfaction, regression 1 indicates that the loss of wellbeing due to a double-shift structure is higher than the loss of wellbeing due to about 20 additional students in the class. However, this calculation has to be considered with care, since the variable DOUBLESIFT is not significant in regression 1.

Teachers' attitude towards the multi-grade system is less clear. This specific type of class management appears to have a positive rather than a negative impact on student achievement. However, as shown in regressions 5 and 6, it goes hand in hand with surprisingly high rates of teacher absenteeism. At the same time, teachers do not show any particular disliking of the system, since the coefficient of MULTGRAD is non-significant (and even positive) with respect to JOBSATIS in regression 1. All in all, the multi-grade system appears to be a sensible management tool that is not in conflict with the objectives of education quality and teacher job satisfaction. However, it should be remembered that it is a tool relevant only for specific situations of small student numbers in remote areas. Moreover, further analysis is needed concerning the high rates of teacher absenteeism it implies.

Concerning the relevance of classroom equipment, regressions 7 and 8 indicate a clearly positive effect of textbooks on student learning. At the same time, regressions 3 and 4 suggest that the equipment with textbooks also has a positive impact on teacher job

⁸ For these and other possible reasons of the negative impact of double-shift classes, see CONFEMEN (2002).

⁹ Given the regression coefficients in regressions 7 and 8, the exact number of students for which the options of double-shift and single-class organization lead to the same overall achievement is 105. Since the calculation is based on estimates, however, it should be avoided to overvalue the exactitude of this figure.

satisfaction. Improving the equipment with textbooks might thus indeed be a valuable, and generally applicable instrument to improve both teachers' job satisfaction and education quality. Some caution is required, though, since the effect on job satisfaction is significant only with respect to the variable CHANGE thereby indicating teachers' desire to teach at those schools which are most well-equipped. This might partly reflect the tendency to choose the relatively most prestigious schools, rather than a positive valuation of books as a relevant tool of instruction. It should in fact be considered, that, when textbooks are newly introduced, teachers need to spend time and effort to adjust to the new methods of instruction. Possibly, the positive effect of the equipment with textbooks on job satisfaction would come out more clearly in the regressions of JOBSATIS as well, if teachers were generally provided pedagogical support and training for the adjustment period. All in all, however, even as the situation is now, improving the availability of textbooks appears to be a relevant policy measure that, in addition, can be implemented at relatively low cost.

Finally, it can be noted that teachers do not only prefer to teach in urban schools or schools close to urban areas, but that these schools also tend to provide better learning conditions (even though this effect is not fully significant since many related variables have already been controlled for). Unfortunately, however, this is no relevant policy variable, since broad educational coverage requires rural schools.

7. Conclusions

Given the relevant determinants of teacher job satisfaction analyzed in section 4 and the relevant determinants of student achievement presented in sections 5 and 6, it can be concluded, that there is a positive impact of teacher job satisfaction on education quality and that therefore, education quality can be influenced by influencing teacher job satisfaction.

However, since many variables have a simultaneous direct impact on both teacher job satisfaction and student achievement, not all factors positively influencing teacher job satisfaction will actually lead to better educational outcomes. In fact, as discussed in section 6, in many cases the relationship between the objectives of improving job satisfaction and student achievement is conflicting rather than complementary. In particular, variables implying a control systems and incentive structures based on a lack of job security seem to have considerable positive effects on teachers' performance while, at the same time, they appear to be strongly disapproved by the teachers concerned. This conflict between the objectives of rising education quality and improving teachers' job satisfaction is particularly obvious with respect to the impact of inspections and non civil service teaching contracts.

There are only a few variables, in fact, whose impact is unambiguously positive regarding both objectives. One is related to classroom equipment which obviously shows a positive effect on teachers' well-being. Among the equipment variables, many do not show any significant influence on student achievement, and were therefore not even presented in the regressions in section 6. This is different, however, for students' equipment with textbooks which are both highly relevant for student achievement, and positively related to teacher job satisfaction. Improving the availability of textbooks is therefore certainly a relevant policy choice.

Another interesting feature is the correspondence between the negative effect of double-shift classes on student learning, and the disliking of teachers for this type of class management. It becomes clear that for both teachers and students, increasing class size should generally be the preferable measure to deal with high student numbers. The negative effect of double-shift classes is so strong that this is true for class sizes up to about 100 students.

The frequently stated hypothesis that low salaries and plethoric class sizes are the major source of both low teacher job satisfaction and low student performance, do not find much support here. While teachers' second jobs indeed appear to rise absenteeism from school, no significant effect on student achievement could be observed. On the basis of this analysis, the extremely expensive effort to increase teachers' salaries therefore does not seem to be a generally adequate policy measure.

With respect to class size, it is true that it has a considerably negative impact on teachers' job satisfaction. Reducing class size would, however, imply to engage more teachers and thereby considerably increase cost. At the same time, the negative impact on educational outcomes seems to be relevant only from a high level of about 65 students onwards. Even then the effect of additional students remains moderate. In this context, and given the relevance of improved access to education in all of the African countries considered here, reducing class size does not seem to be an overly necessary measure and should not be a general policy priority.

Finally, it should be noted that a certain conflict between the objectives of teacher job satisfaction and student achievement also arises with respect to teachers' own qualification. While there is a monotonously positive relationship between their level of educational attainment and educational outcomes, teachers beyond a certain level of qualification (in particular, the baccalauréat) appear to be very disappointed about the realities of their professional life. This result should be taken into account when it is considered to raise the academic requirements to enter the teaching profession, especially since, just as reducing class size and increasing teacher salaries, this is one of the more expensive measures to improve the education systems in these countries.

All in all, it can be concluded that the most intensively debated and highly cost intensive policy measures assumed to be of major importance for both teacher job satisfaction and student achievement do not find much support by the analysis of this study. To the contrary, only simple and relatively cheap measures such as students' equipment with textbooks seem to be unambiguously positive. Moreover, since conflicts between the objectives of teacher job satisfaction and education quality seem to be more relevant than initially assumed, one might feel compelled to promote one objective to the detriment of the other. In particular, one might not be willing to renounce on the control and incentive mechanisms implied by flexible non civil servant contracts and regular inspections since these appear to be highly effective in increasing teachers' performance.

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Appendix

Variable definitions

ABSENCE	Number of days teacher was absent from school during the last month (max=25)
ACTIVITY	Dummy (teacher follows other non teaching/school related activities, such as farming, shop-keeping etc.=1, no such activities=0)
ACTIVPAR	Dummy (students' parents are easily mobilized =1, cannot easily be mobilized =0)
AFAVISIT	Dummy (director feels that family visits are one of the major three reasons for teacher absenteeism =1, else =0)
AGEPLUS	Dummy (age>11 =1, age<=11 =0)
AGETPAY	Dummy (director feels that travel to fetch salaries is one of the major three reasons for teacher absenteeism =1, else =0)
ALONE	Dummy (teacher living alone =1, living with his or her family =0)
ASECJOB	Dummy (director feels that teachers' second jobs are one of the major three reasons for teacher absenteeism =1, else =0)
ASSOC	Number of pedagogical, social or village associations the teacher is a member of
BACPLUS	Dummy (teacher has attained at least a high-school degree "baccalauréat" =1, else=0)
BASEQUIP	Dummy (basic equipment available=1, not available=0) "Basic equipment" includes: teacher's desk, usable blackboard, seats and desks for all students, white chalk, pencils and copy-books or slates for at least 75% of the students.
BOOKS	Share of students equipped with textbooks, average for math and French. When data were available for only one subject, the share in this subject was used as a proxy for the overall share.
C	Constant
CHANGE	Dummy (teacher would like to change the school =1, would like to remain in the same school =0)
CI	Country dummy for Côte d'Ivoire
CM	Country dummy for Cameroon
DIPLPED	Dummy (teacher holds a pedagogical diploma =1, doesn't hold any =0)
DOUBLESIFT	Dummy (several classes using the same room at different times of the day=1, else=0)
EDUCATION	(0,1,...,6) Teacher's educational attainment (below 6 th grade=0, 6 th or 7 th grad=1, 8 th or 9 th grade=2, 10 th or 11 th grade=3, baccalauréat=4, bac. + 1 or 2 years of tertiary education=5, 3 years or more of tertiary education=6)
ELECTR	Dummy (electricity available in class = 1, else = 0)
EXCHANGE	Dummy (teacher often (or very often) asks his colleagues for advice=1, else=0)
EXPER	Number of years of teaching experience
EXPER2	EXPER squared
FRENCH_S	Dummy (French spoken at home=1, not spoken=0)
FRENCH	Dummy (teacher always or often speaking French outside classes=1, else=0)
GENDER	Dummy (male teacher=1, female teacher=0)
GUIDE	(0,1,2) Teacher's manual for math and French available=2, for one subject=1, for none of the two=0
IADVICE	Dummy (visit of the inspector since the beginning of the year to give advice =1, else =0)
IINSPECT	Dummy (visit of the inspector since the beginning of the year to do an inspection =1, else =0)
IMEETPAR	Dummy (visit of the inspector since the beginning of the year to meet students' parents =1, else =0)
INSPECT	Dummy (visit of the inspector since the beginning of the year=1, else=0)
INTERIMDIR	Dummy (teacher has the status of an interim director =1, else =0)

JOBSATIS	Dummy (teacher would again choose the same profession=1, would not=0)
LANGLOC	Dummy (teacher speaks local language=1, does not speak=0)
LIBRARY	Dummy (student can use books at home=1, can't use=0)
LIT_P	(0,1,2) Both parents literate=2, mother or father literate=1, both illiterate=0
MD	Country dummy for Madagascar
MEALS	(3,2,1,0) Regular breakfast, lunch and dinner=3, only two regular meals=2, only one=1, none=0
MEDIA	(0,1,2) Availability at home of: radio and television=2, radio or television=1, neither of the two=0
MEET	(0,1,2,3,4) Director holds a meeting with all teachers at least once a week=4, once a month=3, once per trimester=2, once a year=1, never=0
MULTGRAD	Dummy (students of several grades together in one class=1, else=0)
NOSEM	Dummy (teacher attended no training course within the last five years=1, else =0), only for teachers with at least 3 years of job experience
PILOTPRG	Dummy (school participates in a special program=1, else=0). This special program can be a pilot program, an exchange program with another (foreign) school, an NGO financed project etc.
PTORGA	Sum of activity level of different types of school committees and associations, e.g. parent-teacher organizations (for each: very active=1, active=0.5, slightly active=0.1, not active at all=0)
RATE1	Average student's share of correct answers in the pre-test (average for math and French), for all countries but Senegal (average for all students tested in a particular class)
RATE1_S	Individual student's share of correct answers in the pre-test (average for math and French), for all countries but Senegal
RATE2_S	Individual student's share of correct answers in the post-test (average for math and French), for all countries
RATESN1	Average student's share of correct answers in the pre-test (average for math and French), for Senegal (average for all students tested in a particular class)
RATESN1_S	Individual student's share of correct answers in the pre-test (average for math and French), for Senegal
REPEAT2	Number of grades repeated before the 5 th grade
SN	Country dummy for Senegal
STUDNUMB	Average number of students attending classes
STUDNUMB2	STUDNUMB squared
TOWN	Dummy (urban school=1, rural school=0)
TOWNFAR	Dummy (closest town more than 2 hours away by fastest available means of transportation =1, next city at a closer distance=0)
TRAINING	Number of training courses followed per year during the last five years
TUITION	Dummy (teacher gives private tuition=1, does not=0)
UNION	Dummy (teacher is union member=1, non member=0)
VOLUNT	Dummy (teacher is no civil servant=1, civil servant=0)