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Collaboration levels and feedback among European teachers

A second-level analysis of TALIS 2018 dataset | Volume 2

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Contents

1. Introduction

This report (henceforth: Volume 2), titled "Collaboration levels and feedback among European teachers. A second level analysis of TALIS 2018 data set", complements and deepens the former FBK-IRVAPP's report (henceforth: Volume 1), titled "Continuous professional development, professional capabilities and innovative teaching practices among European teachers. A second level analysis of TALIS 2018 data set", and has been commissioned by European Schoolnet, the network of 34 European Ministries of Education (http://www.eun.org/).

The present report focuses on the levels of cooperation on the job and reciprocal professional feedbacks existing among EU teachers. Moreover, it tries to ascertain whether these two topics are related to those studied in Volume 1, namely to activities of continuous professional development (CPD), induction experiences, innovative teaching practices, students' assessment methods and professional self-efficacy.

To ensure a high level of coherence and consistency, this Volume builds upon the same data set resorted to in Volume 1 (i.e. the information collected by the wave 2018 of the OECD Teaching and Learning International Survey – TALIS), and follows similar methodological approaches.

The report is structured as follows. Section 2 contains a brief description of the sample and methodological tools employed in the analyses. Section 3 presents a descriptive analysis of teachers' levels of collaboration and explores how they are associated with several individual teacher and school characteristics. Moreover, using country level and diachronic (i.e. those collected in the 2013 wave of TALIS) data, it explores the relevant differences existing between EU countries and changes across time relative to the wave TALIS 2013.

In what follows, section 4 investigates the relationship between teachers' collaboration and several of the variables of interest in Vol. 1. Specifically, first, it explores the correlation between CPD activities and collaborative induction activities, and collaboration levels, controlling for individual, school and country characteristics. Subsequently, as mentioned earlier, it tries to identify to what extent higher collaboration levels are related to (i) professional self-efficacy, (ii) the use of innovative teaching practices and (iii) the type of assessment methods employed by teachers.

Section 5 provides several supplementary analyses. In particular, three different topics are investigated: (i) teachers' perception of practical support from colleagues on new ideas and how it relates to collaboration and professional self-efficacy, (ii) the variation across countries in overall hours invested by teachers in collaborative activities, and (iii) the relationship between feedback, innovative teaching practices, and professional self-efficacy.

Section 6 contains a summary and discussion of the main results of the analyses.

Finally, the report is complemented by three appendices containing, respectively, a description of the TALIS 2018 sample (Appendix A); figures depicting sample distributions of teacher's collaboration dimension (Appendix B); and (Appendix C) the lists of specific questions and answers, administered to the interviewees by the TALIS 2018 questionnaire, used to construct the main variables in the analyses.

2. Sample and methodology

2.1. Sample

The main sample, used throughout the analyses, is made up by 63,794 teachers working in 4,399 lower secondary schools (i.e. ISCED level 2) of 23 different EU countries, including Norway (Tab. A.1 in Appendix 1)[1]. They amount to about four fifths (83.5%) of the ISCED 2 teachers (76,435) interviewed in the TALIS in 2018 wave[2]. The difference between the two samples derives from our decision of dropping teachers who did not respond to more than 20% of the items appearing in the questions through which we constructed the two additive indexes developed in order to measure the levels of professional collaboration and of exchange and coordination for teaching existing among EU teachers[3].

Several of the TALIS 2018 countries (Austria, Cyprus, Hungry, Lithuania, Malta and Slovenia) did not participate in the 2013 survey. Therefore, the number of countries declines to 17 when exploring changes from 2013 to 2018 in our main topics.

2.2. Methodology

For consistency and coherence, Volume 2 follows the same methodological approach employed in Volume 1. As more accurately described in section 3, the two main variables underlying our analyses – i.e. those expressing, respectively, the levels of professional collaboration and the levels of exchange and co-ordination for teaching – were constructed through additive indexes obtained by: (i) summing up the scale values of each item expressing the individual interviewee's answers to the relevant question; and (ii) standardising the resulting individual score by subtracting from it the overall sample mean of the score and dividing this difference by the standard deviation of these same scores. This procedure ensures that, in most cases, the distribution of the variable is close to a bell-shaped normal distribution. In turn, it simplifies the interpretation of results, making them comparable with results from other studies in the literature.

However, in several other cases, instead of computing additive indexes, we based our analyses on dichotomous variables resulting from the aggregation of the responses to a specific item in two different values (usually 0 and 1). In this way, we were able to use the relevant variables as dependent variables in linear probability models. Whenever we needed to deviate from these protocols – i.e. additive indexes and dichotomies – when constructing a specific variable, we expressly describe the specific procedure adopted and motivate our choice.

1 Germany, Greece, Ireland, Luxembourg and Poland did not take part in TALIS 2018. In addition, United Kingdom is part of the 23 countries covered, although it is no more an EU member country since January 2020.

2 Participating countries could choose whether to survey also ISCED 1 and ISCED 3 teachers. Nevertheless, the main focus of TALIS 2018 were teachers working in schools placed at ISCED level 2; hence all European countries participating at the survey administered TALIS questionnaire within sampled schools of ISCED level 2.

3 The 20% threshold is a generally accepted rule of thumb regarding the selection of cases to be considered in order to develop sound and reliable additive indexes. See, for instance, Downey and King (1998), Shrive et al. (20026).

As described in detail in Volume 1 and implicitly suggested earlier, the main statistical models used are linear regression models and linear probability models. They allow to study the partial correlation between two variables of interest, after removing the influence of other potentially confounding factors. For instance, when investigating the relationship between teacher's collaboration and innovative teaching practice, we want to control for the formal preparation of the teacher, since a higher preparation is likely to be correlated with both higher teachers' collaboration and higher use of innovative teaching practice. Similarly, we also need to control for other individual, school and country characteristics. Even though causality between the main covariates and the dependent variable appearing in the various models cannot be claimed, we at least rule out important confounders and get closer to a causal relationship.

A novel tool used in this volume is the intra-class correlation coefficient (ICC). This measure is computed by decomposing the variance of a given variable into: (i) the share explained by differences between the units at a given level of aggregation (schools in our case) and (ii) the share explained by differences within the units of aggregation (between teachers working at the same school). Analytically, the ICC is the ratio of the between units variance (i.e. between schools) to the overall variance. Therefore, it takes on values from 0 to 1, and indicates the share of the overall variance explained by between-school differences. Let's take the extreme cases to clarify its interpretation. An ICC value of 0 indicates – for all individual schools – that there is no correlation between the outcomes of teachers working in the same schools. Thus, there is no variance between schools and, as a result, the whole observed variance is going to be explained by within school differences. In contrast, an ICC value of 1 indicates perfect homogeneity of teachers working at the same school, in other words, no within school variance. Thus, all the variability of the indicator is going to be explained by differences between schools.

3. Professional collaboration and exchange and co-ordination for teaching

This section deals with two dimensions of teachers' collaboration: (i) professional collaboration and (ii) exchange and co-ordination for teaching. We first present descriptive statistics for each dimension. Next, we explore, through multivariate regression models, the associations between each dimension of teachers' collaboration and several teachers' and schools' characteristics. Finally, we discuss how they vary between European countries and across time.

3.1. A general outline of the collaboration levels

The TALIS 2018 questionnaire includes a specific question (q33) regarding teachers' collaboration levels. It asks teachers with what frequency they perform the following activities at school: (i) teach jointly as a team in the same class, (ii) observe other teachers' classes and provide feedback, (iii) engage in joint activities across different classes and age groups, (iv) exchange teaching materials with colleagues, (v) engage in discussions about the learning development of specific students, (vi) work with other teachers in the school to ensure common standards in evaluations for assessing student progress, (vii) attend team conferences and (viii) take part in collaborative professional learning. These items are divided into two different groups measuring two different dimensions of teachers' collaboration[4]: professional collaboration and exchange and co-ordination for teaching. Table 3.1 below shows which items correspond to each dimension and provides the relevant distribution of teachers' responses to every individual item.

4 OECD (2019) provides two different collaboration scales using multiple-group confirmatory factor analysis (MGCFA).

Table 3.1 Distributions of items of teachers' collaboration levels. Percentages.

	Never	Once a year or less	2-4 times a year	5-10 times a year	1-3 times a month	Once a week or more
Professional collaboration						
Teach jointly as a team in the same class	46.42	13.81	11.09	4.92	4.77	18.99
Observe other teachers' classes and provide feedback	46.75	20.40	18.66	5.93	4.42	3.83
Engage in joint activities across different classes and age groups	21.72	22.47	32.15	12.00	6.39	5.27
Take part in collaborative professional learning	19.21	23.32	29.13	13.76	9.14	5.44
Exchange and co-ordination for teaching						
Exchange teaching materials with colleagues	6.63	8.39	18.08	18.36	25.07	23.47
Engage in discussions about the learning development of specific students	2.68	3.20	12.60	15.12	26.83	39.57
Work with other teachers to ensure common standards in evaluations	10.77	10.83	21.98	17.05	22.17	17.20
Attend team conferences	7.57	5.94	15.44	24.27	27.02	19.77

Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

Looking at the percentages recorded in that table, one can immediately realise that there is great heterogeneity in both dimensions of teachers' collaboration (Tab. 3.1). While some teachers engage in collaborative school activities on a monthly basis or even more frequently, others do so less than once a year. For instance, slightly less than half of the teachers declare they never teach jointly as a team in the same class (46.42%). In contrast, roughly 1 in 5 teachers (18.99%) participate in such activities at least on a weekly basis. Summing up the individual items across each dimension, we observe that activities related to exchange and co-ordination for teaching are more frequently performed by teachers than professional collaborations.

Table 3.2 Descriptive statistics for the additive standardised indexes of professional collaboration.

	Mean	SD	Min	Max	N
Professional collaboration:	0	1	-1.59	3.29	63794
Exchange and co-ordination for teaching:	0	1	-3.10	1.66	63794

Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

As mentioned above, to measure the overall intensity of the activities grouped in each of the two dimensions indicated in Table 3.1 we constructed standardized additive indexes that sum up the responses to every individual item belonging to a given dimension[5]. The two indexes have, by construction, a mean equal to 0 and standard deviation 1. The professional collaboration index takes on values from -1.59 to 3.29, while the exchange and co-ordination for teaching index varies from -3.10 to 1.66 (Tab. 3.2).

5 Numerical values are assigned to each response 1 if an activity was never performed, to 6 if an activity was performed once a week or more often. The values are then summed up into a score which is standardized to have mean 0 and standard deviation 1.

The distributions of the two variables are relatively symmetric (Fig. B.1 and B.2 in appendix B) although the first index presents a fatter tail on the right, while the second one on the left. This means that (i) there is roughly an equal number of teachers above and below the mean and (ii) that there are several teachers with high levels of professional collaboration and several teachers displaying low levels of exchange and co-ordination for teaching activities, relative to the European average. Regarding the latter, it has to be stressed that we have not been able to compute the relevant indexes for French teachers because two items used for their construction were completely missing.

3.2. Variations of the collaboration levels according to teachers and school characteristics

To analyse how some selected teachers' traits and some school characteristics influence the two collaboration dimensions, we specified two linear regression models.

Starting from the model regarding the professional collaboration index (Tab. 3.3, column 1), we notice that the latter is not correlated with interviewees' gender. On the contrary, the index is influenced by the respondents' level of education. This association appears to be negative: the higher the school qualification, the lower the collaboration index score (Tab. 3.3, column 1). However, the subsequent set of three covariates display effects closer to those one would expect. Indeed, teachers with a full-time contract, higher score in the formal education preparedness index and those who chose their current occupation on the basis of societally oriented motivations carry out more frequent collaboration teaching activities. Moreover, the model we are commenting upon shows that teachers of Humanities and Arts collaborate more frequently than those teaching STEM and social sciences. Finally, it has to be noted that the length of professional experience displays a slight curvilinear relation with professional collaboration activities. Namely, they are rather uncommon at the beginning of the teacher's career, then they increase their frequency and subsequently – i.e. in the late phase of work history – they decline (Tab. 3.3, column 1).

Moving on to school and class characteristics, we find that professional collaboration is a more frequent practice in private and more innovative schools. The same holds for schools with a higher share of students with special needs, a higher teacher to management personnel ratios and a lower teacher to pedagogical support personnel ratios (Tab. 3.3, column 1).

Turning to the index expressing the intensity of exchange and co-ordination for teaching (Tab. 3.3, column 2), the relevant model leads to results similar to those just described above. The few slight differences are as follows. First, female teachers appear to be less inclined to perform exchange and coordination activities than their male counterparts. Second, STEM teachers carry out these activities more often than their colleagues of Arts and Social Sciences[6]. Third, the length of professional experience does not influence the level of the exchange and coordination experiences (Tab. 3.3, column 2).

6 This could be in part due to the fact that in some countries STEM classes are managed by multiple teachers.

Looking now at the effects of school characteristics, it can be noticed that large classes require higher exchange and co-ordination efforts than the smaller ones. School location also appears to matter: teachers in rural schools show lower engagement levels in this kind of activities than those in town or city schools[7]. Finally, school delinquency index is positively associated with the intensity of exchange and co-ordination initiatives, likely because teaching in such difficult conditions requires more cooperation among teachers (Table 3.3, column 2).

Table 3.3 Estimated coefficients of linear regression models regarding teachers' collaboration levels.

	Professional collaboration index	Exchange and co-ordination for teaching index
Teachers characteristics		
Gender		
• Male (ref.)	-	-
• Female	-0.003	-0.169***
Education level		
• Non-tertiary (ref.)	-	-
• Bachelor	-0.111***	-0.063*
• Master or above	-0.158***	-0.112***
Type of contract		
• Part-time (ref.)	-	-
• Full-time	0.151***	0.137***
Teacher formal education preparedness index (std)	0.109***	0.084***
Teacher formal education preparedness to use ICT		
• No (ref.)	-	-
• Yes	-0.016	0.021
Teacher career choice motivation: personal or job related (std)	-0.022***	-0.020*
Teacher career choice motivation: societal contribution (std)	0.063***	0.065***
Main subject taught		
• STEM (ref.)	-	-
• Languages and literature	0.032*	0.050***
• Social sciences	-0.016*	-0.031
• Arts	0.105***	-0.184***
• Other	0.152***	-0.173***
Work experience (years)	0.005*	0.003
Work experience (years) squared	-0.000***	-0.000
Schools characteristics		
School location		
• Rural: up to 3,000 people (ref.)	-	-
• Town: 3,001 to 100,000 people	-0.019	0.038*
• City: more than 100,000 people	0.032	0.041*
School governance		
• Private school (ref.)	-	-
• Public school	-0.040*	0.009
Schools with high level of students' language		
• No (ref.)	-	-
• Yes	-0.045	-0.010
Schools with high level of students with special needs		
• No (ref.)	-	-
• Yes	0.036**	-0.009
Schools with high level of socio-economically disadvantaged students		
• No (ref.)	-	-
• Yes	0.061*	0.014
Class size	-0.000	0.004***
Innovative practices of colleagues as perceived by teachers (std)	0.138***	0.185***

7 One possible explanation is the fact that rural schools are generally smaller and have fewer teachers.

School shortage of resources index (std)	0.004	0.008
Student – Teacher Ratio	-0.001	0.002
Teacher – Pedagogical Support Personnel Ratio	-0.001**	-0.001***
Teacher – Administrative or Management Personnel Ratio	0.004**	0.002
School delinquency index (std)	-0.012	0.016**
Constant	0.227***	-0.102*
Country fixed effects	X	X
R2	0.138	0.160
N	63794	63794

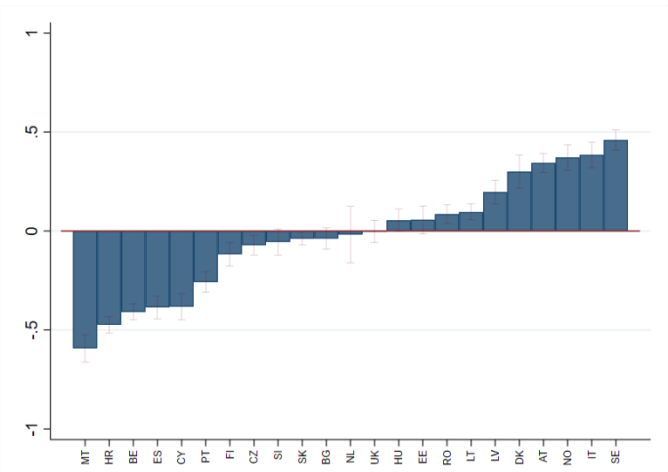
Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

3.3. Variation across countries of the collaboration levels

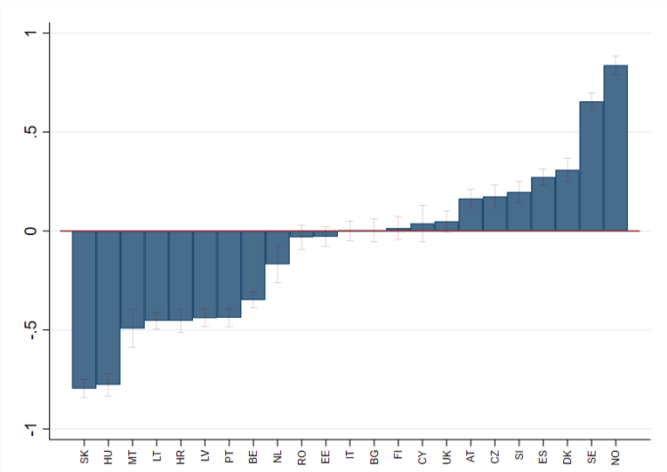
Having investigated individual differences between teachers and between schools in the levels of professional collaboration and exchange of teaching experiences, we now turn to cross-country comparisons. Figure 3.1 plots the mean values and their 95% confidence intervals of our two additive indexes for each country in the sample. The figure shows that teachers' collaboration intensity varies significantly across EU countries. The differences are more pronounced for exchange and co-ordination for teaching than for professional collaboration.

Figure 3.1 Teachers' collaboration levels in European countries.

Panel a: Professional collaboration index



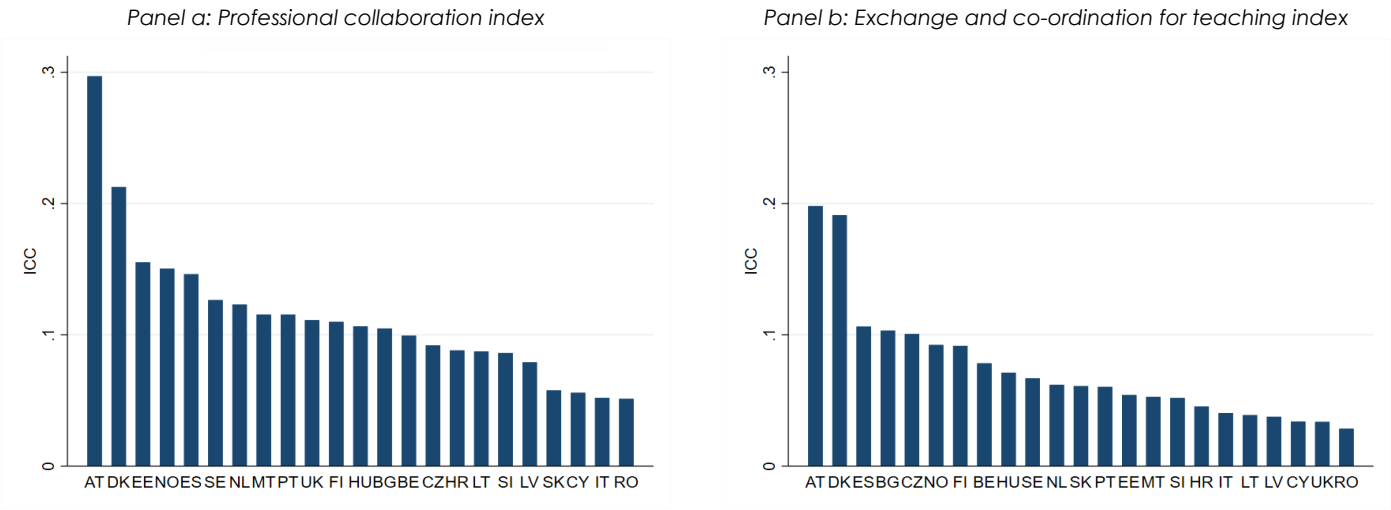
Panel b: Exchange and co-ordination for teaching index



Source: FBK-IRVAPP analysis of TALIS 2018 Estimates obtained using replicate weights and final teacher weights provided by TALIS. The information is not available for France.

Several Nordic countries (Sweden, Denmark and Norway) are at the top of both distributions, showing much higher collaboration levels than the European average. In contrast, the bottom of the two distributions appears to be rather heterogeneous from a geographical point of view. While, on average, teachers from Malta, Croatia, Belgium and Portugal lie far below the European average for both dimensions, several other countries (such as Spain, Latvia, Italy and Hungary) record low levels for one dimension while being at or above the European average for the other dimension.

Figure 3.2 The intra-class correlation coefficients of collaboration dimensions across countries.



Source: FBK-IRVAPP analysis of TALIS 2018 Estimates obtained using replicate weights and final teacher weights provided by TALIS. The information is not available for France.

In order to better describe the between-countries differences in the levels of teachers' professional cooperation, besides average, also the degree of variability of the national distributions of our standardised additive indexes has to be studied. To do that, we investigated to what extent the variation within each country is explained by (i) differences between teachers working in the same schools, or by (ii) differences between schools. In practice, for each country, we decomposed the overall variance of the two dimensions of teachers' collaboration and computed the ICC[8]. As explained in sub-section 2.2, it indicates the share of the variance explained by differences between schools. The remainder represents, the share of the variance explained by within-school differences, that is to say the variability existing between the teachers working in the same school. We remind that an ICC value of 1 indicates that all teachers within a given school have the same collaboration levels implying that differences between schools explain the entire variation in the collaboration levels observed in a country. Conversely, a value of 0 indicates a complete heterogeneity in the levels of professional collaboration displayed by the teachers of each given school, implying that within school differences explain the entire variation in the values of our additive indexes. Thus, a higher ICC signals higher within school homogeneity.

Figure 3.2 above presents the ICC of each collaborative dimension for each country in our sample. ICC is generally larger for professional collaboration than for exchange and co-ordination for teaching. However, even though some differences exist, the overall ranking of countries in the ICCs for the two dimensions is very similar. Austria and Denmark stand out with higher within school homogeneity. On the contrary, Romania, Cyprus and Latvia are in the bottom of the distribution of ICC values for both dimensions. This result indicates a low degree of within school homogeneity. In other words, within a given school in these countries, we can expect large variations (low correlation) in (between) the levels of teachers' collaboration.

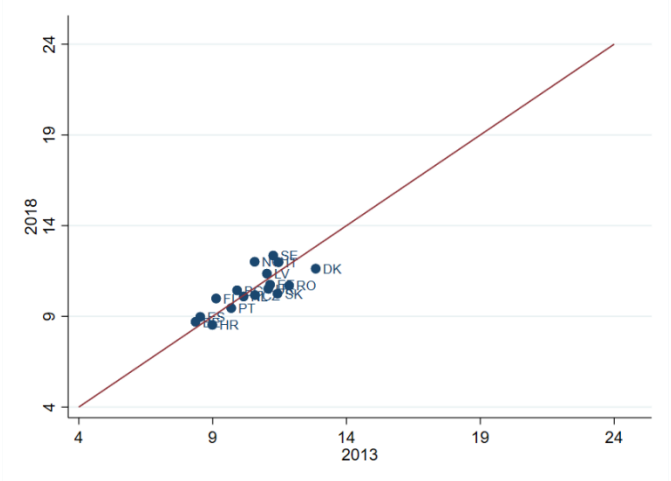
8 See sub section 2.2. for a more detailed description of the ICC, i.e. the intra-class correlation coefficient.

3.4. Variation over time and across countries in the collaboration levels

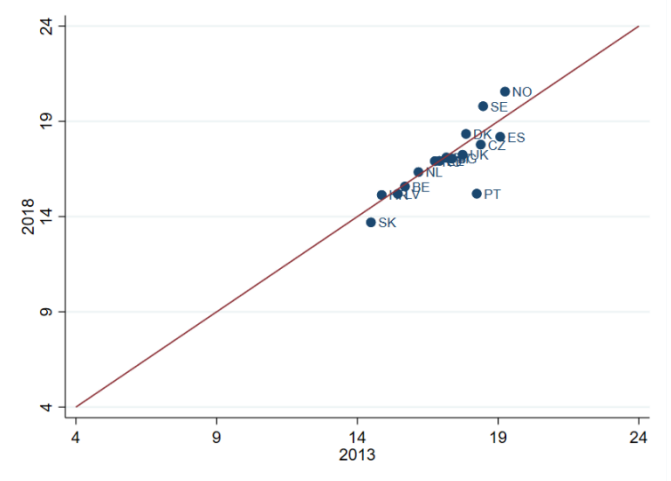
In order to examine changes in teachers' collaboration levels over time, we looked at both the 2013 and 2018 waves of TALIS. Unfortunately, this analysis cannot be performed using our usual standardised additive indexes. This is so because in the two surveys the distributions of the summative scores deriving from the relevant items of the question regarding professional collaboration display different means. Therefore, the analysis of the variations over time and across countries in the levels of collaboration still rely on additive indexes, but their values are not standardised. Nonetheless, higher values of each index continue to indicate that teachers frequently perform the relevant set of cooperative activities, while lower values signal less frequent performance in collaborative activities. Two main results emerged from our comparisons (Fig. 3.3). First, in 2013, as in 2018 European teachers, on average, tended to perform more frequently exchange and co-ordination for teaching activities than professional collaborations, confirming what emerged from Table 3.1. Second, there exists no significant change over time for both collaborative dimensions. On average, countries with high (or low) levels of collaboration in 2013 show high (or low) levels of collaboration also in 2018[9].

Figure 3.3 Variation between 2013 and 2018 in the teachers' collaboration levels.

Panel a: Professional collaboration index



Panel b: Exchange and co-ordination for teaching index



Source: FBK-IRVAPP analysis of TALIS 2013 and 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS. The information is not available for Austria, Cyprus, Hungary, Lithuania, Malta and Slovenia and France. The red line is the bisector of the first quadrant.

9 Only Portugal records a sizeable decrease over time in the levels of exchange and co-ordination for teaching experiences.

4. Levels of collaboration, CPD activities, collaboration in induction, self-efficacy, innovative practices and assessment methods

In the previous section we identified several teachers and school characteristics associated with the levels of teachers' collaboration. This section explores the relationships between levels of collaboration and some other aspects of their professional activities already studied in the previous report (Vol. 1) controlling for the same teacher and school characteristics presented in the above section. More precisely, in the following pages we will explore, first, if (i) participation in CPD activities and (ii) collaboration in induction are able to predict the two dimensions of teachers' collaboration. Then, we will try to assess if (iii) the levels of collaboration are associated with the use of innovative teaching practices, the adoption of assessment methods and professional self-efficacy.

4.1. Association between CPD activities and levels of collaboration

To investigate whether participation in continuous professional development (CPD) activities is associated with levels of collaboration, we proxied CPD participation through a standardized general index[10] indicating the variety of CPD activities followed by teachers in the previous 12 months. Higher values of this index correspond to teachers who attended a wider number of different types of CPD activities, while lower values indicate otherwise. On average, teachers who attended more CPD activities show higher levels of both professional collaboration and exchange and co-ordination for teaching activities (Tab. 4.1, columns 1 and 3). Both estimates are large and highly statistically significant and indicate that after controlling for individual, school and country characteristics, an increase of one standard deviation in CPD participation is associated with higher professional collaboration and exchange and co-ordination for teaching by, respectively, 0.24 and 0.15 standard deviations on average. We note that the effect size of CPD is larger for professional collaboration.

To deepen our analyses, we investigated which specific CPD activity better predicts collaboration levels (Tab. 4.1, columns 2 and 4). We focused on four CPD activities: (i) online courses or seminars; (ii) peer, coaching or network of teachers; (iii) observation visits; and (iv) in

10 For more details of index construction, see Vol. 1, p. 6.

person formal training. As specified in Vol. 1, the first activity refers to whether teachers attended online courses or seminars. The second activity indicates whether the teacher participated in (a) peer and/or self-observation and coaching as part of a formal school arrangement, or in (b) a network of teachers formed specifically for professional development. The third activity refers to whether teachers performed observation visits to other schools, business premises, public organisations, or non-governmental organisations. The last activity indicates whether teachers attended (a) education conferences where teachers and/or researchers present their research or discuss educational issues, (b) in person courses/seminars or (c) a formal qualification programme. If the teacher did participate in any of the activities in the past 12 months, the variable is coded as 1 and 0 otherwise.

The regression estimates indicate that all CPD activities are positively associated with both dimensions of teachers' collaboration. We note that the relationship is always stronger with respect to professional collaboration. Participation in peer, coaching or network activities has the highest estimated coefficients in both models, followed by observation visits for the former outcome, and in person formal training for the latter. While significant in both models, the estimates on online CPD activities are the smallest in magnitude.

For the sake of clarity, it has to be stressed that while correlation between CPD participation and teacher's collaboration is definitely strong, even after conditioning on country and a rich set of teacher and school characteristics, causality cannot be claimed. In this particular case, it is difficult to even pin down the potential direction of causality. While participating in CPD activities may encourage or foster collaboration, exchange and co-ordination with other teachers, the reverse is also possible. Teachers may discover or be stimulated to attend CPD activities by interacting and working together with their colleagues.

Table 4.1 Estimated coefficients of linear regression models using as outcome variable teachers' collaboration levels and as main covariates the indexes of CPD.

	Professional collaboration index		Exchange and co-ordination for teaching index	
CPD general index (std)	0.249***		0.150***	
CPD: Online courses/seminars				
• No (ref.)		-		-
• Yes		0.113***		0.085***
CPD: Peer, coaching or networking				
• No (ref.)		-		-
• Yes		0.290***		0.159***
CPD: Observation visits				
• No (ref.)		-		-
• Yes		0.227***		0.096***
CPD: In person formal training				
• No (ref.)		-		-
• Yes		0.151***		0.118***
Teachers characteristics	X	X	X	X
Schools characteristics	X	X	X	X
Country fixed effects	X	X	X	X
R2	0.177	0.173	0.180	0.179
N	63794	63794	63794	63794

Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

4.2. Association between collaboration in induction experiences and levels of collaboration

As it is well known, induction experiences are activities designed to support: (i) new teachers when they begin their profession and (ii) teachers who join a new school. Among the induction experiences present in the TALIS questionnaire, two in particular are expected to directly encourage future collaborative actions: (i) networking/collaboration with other new teachers and (ii) team teaching with experienced teachers. As remarked in Vol. 1, induction activities are not widespread among the respondents to the TALIS 2018 survey. Only about 1 teacher out of 4 (24,13%) attended the first activity while about 1 teacher out of 7 (14,42%) attended the latter. To identify possible relations between induction experiences and professional collaboration activities, we performed an analysis similar to the one presented in the former sub-section, using as main explanatory variables the above-mentioned induction activities, coded as 1 if the teacher attended the activity and 0 otherwise.

Table 4.2 Estimated coefficients of linear regression models using as outcome variable teachers' collaboration levels and as main covariates the variable of collaboration in induction.

	Professional collaboration index	Exchange and co-ordination for teaching index
Induction activities: networking\collaboration with other new teachers		
• No (ref.)	-	-
• Yes	0.137***	0.147***
Induction activities: team teaching with experienced teachers		
• No (ref.)	-	-
• Yes	0.389***	0.188***
Teachers characteristics	X	X
Schools characteristics	X	X
Country fixed effects	X	X
R2	0.146	0.164
N	25749	25749

Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

Table 4.2 presents the results of the regression analysis. Note that the analytical sample is smaller because many teachers did not participate in any induction activities[11]. Therefore, we restrict this analysis to teachers who attended at least one induction activity. After controlling for individual, school and country characteristics, we observe that (i) networking/collaboration with other new teachers and (ii) team teaching with experienced teachers, during induction, are positively associated with higher levels of collaboration in both studied dimensions. The effect size of team teaching with experienced teachers is stronger than the estimate on participation in networking or collaboration with other new teachers, especially with respect to professional collaboration, reaching a sizable value of 0.38 standard deviations.

11 See Vol. 1.

4.3. Association between levels of collaboration, innovative practices and assessment methods and self-efficacy

Thus far, the analyses focused on potential determinants of collaboration among teachers. In this section, we instead asked how engaging in collaborative activities may impact (i) the use of innovative practices, (ii) assessment methods, and (iii) professional self-efficacy.

As detailed in Vol. 1, innovative teaching practices were proxied by an index constructed using the items of the relevant question of TALIS 2018[12]. High levels of this index correspond to teachers who resort to a wide set and more frequent use of innovative teaching practices; conversely low values indicate a low variety and infrequent use of such practices in teaching. The four types of assessment methods employed by teachers and studied in this report are as follows: (i) administering own assessments, (ii) allowing students to evaluate their own progress, (iii) offering written feedback in addition to marks/grades, and (iv) observing students when performing a task and providing immediate feedback. As already stated in Vol. 1, professional self-efficacy refers to teachers' beliefs in their capacities to productively use teaching practices and assessment methods in their classroom and to develop positive behavioural and cognitive outcomes among their students. This trait is measured following a procedure very similar to that adopted for the two dimensions of teacher's collaboration.

To study the influences of the two dimensions of collaborative activities on the indexes of professional self-efficacy and innovative teaching practices we ran, as usual, two regression models (Tab. 4.3, columns 1 and 2). The same statistical procedure was adopted for analysing the impact of the collaborative initiatives on the assessment methods indicators (Tab. 4.3, columns 3-6). All the regressions models control for individual, school and country characteristics.

Table 4.3 Estimated coefficients of linear regression models using as outcome variable indexes of professional self-efficacy, innovative teaching practices and assessment methods and as main covariates teachers' collaboration levels.

	Professional self-efficacya	Innovative teaching practices[a]	Teacher's own assessment[b]	Student self-evaluation[b]	Additional written feedback[b]	Immediate feedback[b]
Professional collaboration index (std)	0.098***	0.118***	0.003	0.007	0.069***	0.037***
Exchange and co-ordination for teaching index (std)	0.141***	0.130***	0.017***	0.053***	0.022***	0.021***
Teachers characteristics	X	X	X	X	X	X
Schools characteristics	X	X	X	X	X	X
Country fixed effects	X	X	X	X	X	X
R2	0.189	0.128	0.074	0.168	0.145	0.040
N	63794	63794	63794	63794	63794	63794

*Source: FBK-IRVAPP analysis of TALIS 2018. Estimates of coefficients obtained using a) Linear regression model, and b) Linear probability model applied to TALIS provided replicate weights and final teacher weights. * p <0.10, ** p <0.05, *** p <0.01.*

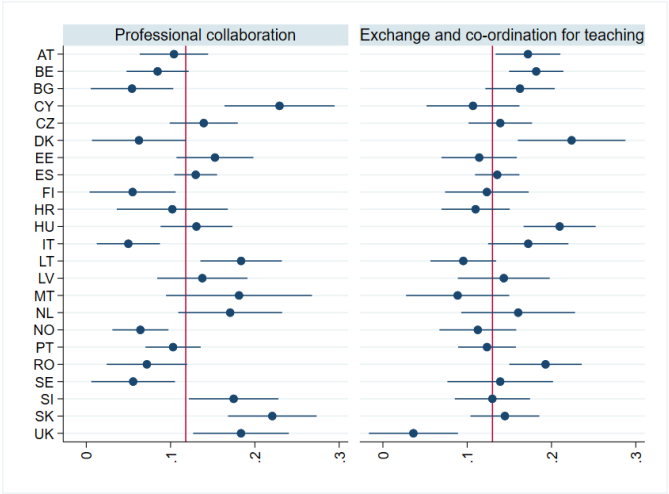
Results are as follows. Both dimensions of teachers' collaborations are positively associated with innovative teaching practices and professional self-efficacy, with estimates close in magnitude and of moderate size. In other words, after controlling for individual, school and country

12 For more details of index construction, see Vol. 1 p. 19.

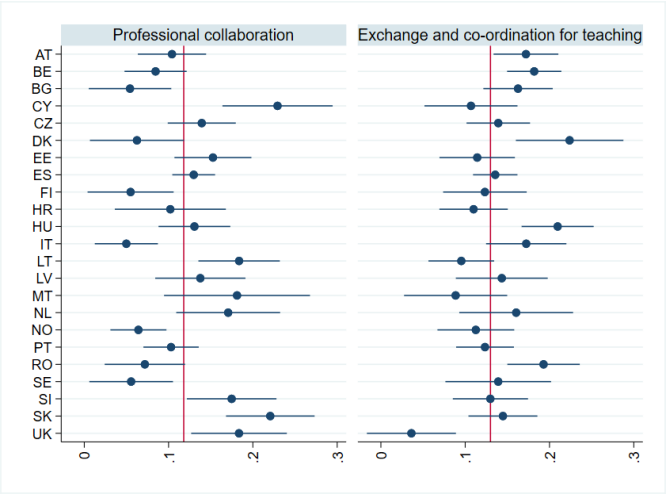
characteristics, we find that teachers who are more collaborative in their profession show stronger belief in their pedagogical abilities and tend to be more innovative in their teaching. With respect to assessment methods, results are slightly different. While engaging in exchange and co-ordination for teaching is associated with a higher likelihood of employing each individual assessment method, higher professional collaboration is significantly associated only with a higher propensity to provide feedback to students, either additional written feedback or immediate feedback.

Figure 4.1 Estimated coefficients of linear regression models using as outcome variables innovative teaching practices, professional self-efficacy and assessment methods and as main covariates the indexes of teachers' collaboration levels across countries.

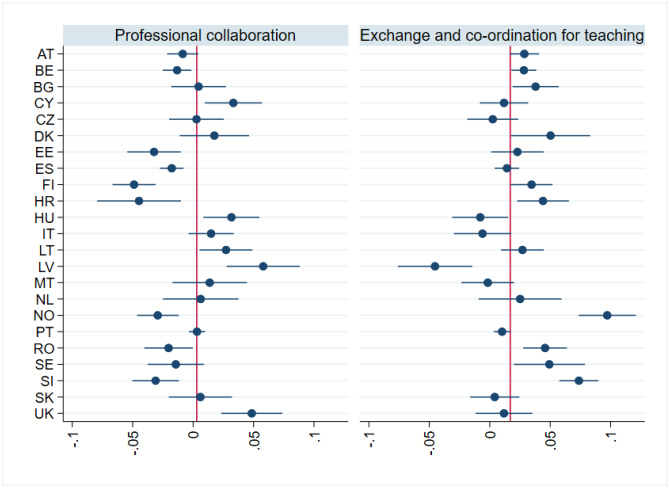
Panel a: innovative teaching practices



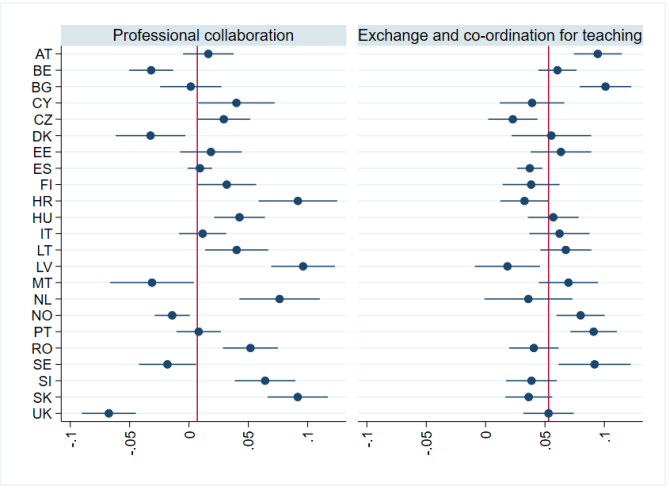
Panel b: professional self-efficacy



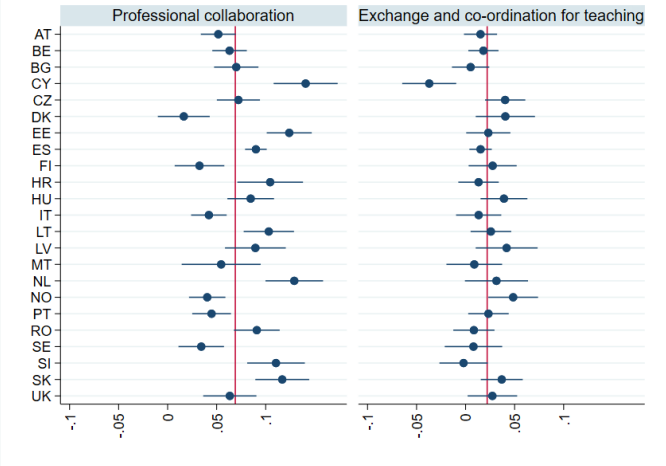
Panel c: Teacher's own assessment



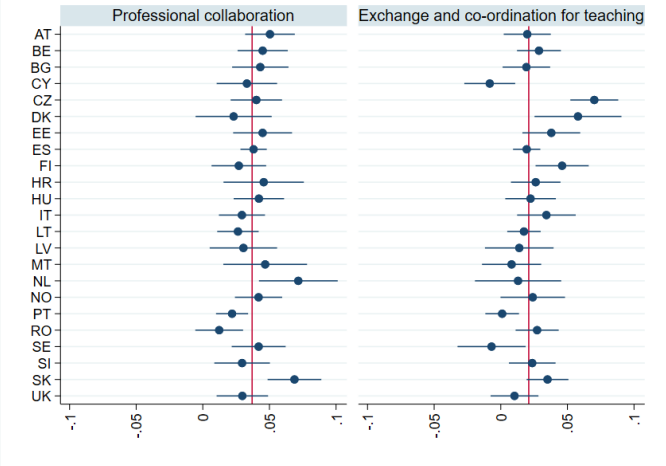
Panel d: Student self-evaluation



Panel e: Additional written feedback



Panel f: Immediate feedback



Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS. Red lines represent the coefficients for all European countries.

The analysis so far controlled for country characteristics, but the estimated effects are the average effects at European level, potentially hiding no effects or effects of the opposite direction at country level. In order to assess this, we ran the same models presented in Table 4.3, columns 1 and 6, separately for each country (Fig. 4.1). The figures show the estimated coefficients (and relative 95% confidence interval) for each country depicting the association between collaborative dimensions and teaching practices (Fig. 4.1, panel a), professional self-efficacy (Fig. 4.1, panel b) and assessment methods (Fig. 4.1, panels c-f). The vertical red lines represent the average estimated coefficient for all European countries.

First, we observe for innovative teaching practices and professional self-efficacy, that while some country level estimates are not statistically different from zero, none are negative. Regarding innovative teaching practices, the estimates of the influence of professional collaboration vary from around 0.05 standard deviations in all Scandinavian countries and several others, to large effects sizes of 0.20 standard deviations and above in Cyprus and Slovakia. There is far less variation on the estimates for exchange and co-ordination, with the exceptions of Denmark, Hungary and Romania which are above the mean, and the United Kingdom which is significantly lower. Looking at the association between professional collaboration and professional self-efficacy, we can observe a similar picture: much larger variation for professional collaboration than for exchange and co-ordination. For the first dimension, Belgium, Italy, Norway and Portugal show lower associations whereas Czechia, Lithuania and Latvia among others, have larger estimated coefficients than the mean. With respect to exchange and co-ordination for teaching, all coefficients are not different from the European coefficient except for Portugal, Spain and Slovenia (lower than the mean), and Denmark, Estonia, Hungary and Romania (higher).

For what concerns assessment methods, we observe that the effects on them at country level vary a lot and that, in several cases, they are changing even sign. Starting with the first assessment method – teacher's own assessment – we find that the null effect size at European

level hides substantial variation. The estimates on professional collaboration become quite often statistically significant. In several countries (Cyprus, Hungary, Latvia, United Kingdom) they turn out to be positive, while they appear to be negative in others (Estonia, Spain, Finland, Greece, Norway, Romania, Slovenia). The estimates of exchange and co-ordination influence also vary, however not necessarily in the same direction as for the other dimension, making it hard to identify a consistent pattern. The variations are even more pronounced for the second assessment method – student's own evaluation – while for the other two – additional written feedback and immediate feedback, the estimates are relatively more similar across countries. It might be that these differences between countries reflect the fact that formal and informal norms regarding assessment methods vary from country to country. Through interactions between teachers in collaborative activities, these norms are likely to be reinforced leading to more pronounced differences between countries.

5. Supplementary analyses

This section provides several supplementary analyses investigating (i) the association between the perception of practical support from colleagues on new ideas and levels of teachers' collaboration and professional self-efficacy; (ii) the overall hours invested by teachers in collaborative activities; (iii) the feedback that teachers received.

5.1. Association between perception of practical support from colleagues on new ideas and levels of collaboration and self-efficacy

The TALIS 2018 questionnaire included a question (q32d) asking teachers how strongly they agree or disagree – on a scale with values ranging from 1 (strongly disagree) to 4 (strongly agree) – with the statement "most teachers in this school provide practical support to each other for the application of new ideas". For the purpose of the analysis, we recoded the four modalities of the variable to a dichotomous scale taking on the value equals 0 if teachers strongly disagree or disagree and 1 if they agree or strongly agree with the statement.

Similar to previous analyses, we resorted to three different multivariate regression models to assess the association between the teacher's perception of practical support from colleagues on new ideas and levels of teachers' collaboration and professional self-efficacy (Tab. 5.1). Not surprisingly, after controlling for individual, school and country characteristics, teachers who state that they get practical support from colleagues on new ideas are those who engage in more collaborative activities with other teachers. More precisely, those who answer positively to the above-mentioned question show 0.06 and 0.16 standard deviations higher professional collaboration and exchange and co-ordination for teaching, respectively. In contrast, the perception of practical support from colleagues on new ideas is negatively associated with professional self-efficacy. In other words, teachers who feel more practically supported by their colleagues are those with lower levels of professional self-efficacy. If this result is to be treated as causal, it would imply that teachers frequently looking for practical support may feel less autonomous and, therefore, less confident in their own abilities. However, reverse causality may be at stake. Teachers with high self-efficacy may not require as much support from colleagues when pursuing a new idea. Conversely, those with low self-efficacy may be the ones asking for and receiving more support and as a result perceive more positively the support from their colleagues

Table 5.1 Estimated coefficients of linear regression models using as outcome variables teachers' collaboration dimensions and, professional self-efficacy and as main covariate the teachers' perception of practical support from colleagues on new ideas.

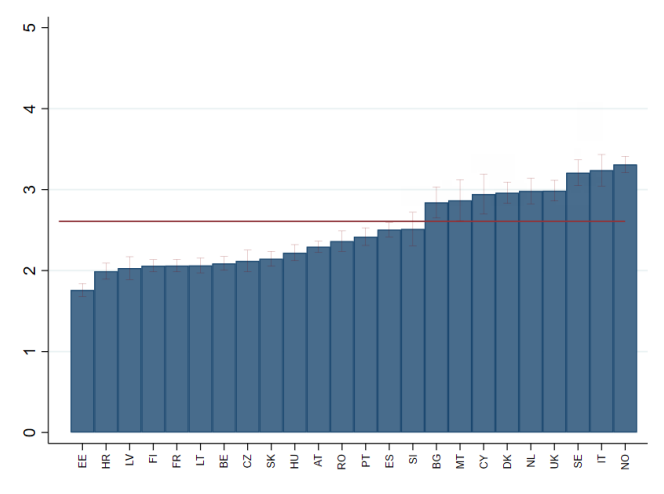
	Professional collaboration index	Exchange and co-ordination for teaching index	Professional self-efficacy
Perception of practical support from colleagues on new ideas			
• Strongly disagree\Disagree (ref.)	-	-	-
• Agree\Strongly agree	0.063***	0.168***	-0.109***
Teachers characteristics	X	X	X
Schools characteristics	X	X	X
Country fixed effects	X	X	X
R2	0.112	0.160	0.161
N	63794	63794	63794

Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

5.2. Variation across countries of overall hours invested by teachers in collaborative activities

To more accurately understand teachers' collaboration, we analysed the overall hours invested by teachers in team work and dialogue with colleagues. More precisely, teachers indicate how many hours they spent in collaborative activities during their most recent complete calendar week, including tasks that took place during weekends, evenings or other out of class hours. On average, European teachers spend more than 2 hours and 30 minutes in collaborative activities per week (Fig. 5.1). This varies across countries, from about 1 hour and 45 minutes per week in Estonia, to roughly 3 hours and above in all Scandinavian countries (except Finland), Italy, the UK, Netherlands, Cyprus, Malta and Bulgaria. These results confirm approximately what emerged in subsection 3.3, as indicated by significant Spearman rank correlation coefficients of 0.28 and 0.49 between hours invested by teachers in team work and dialogue with colleagues within school and, respectively, professional collaboration and exchange and co-ordination for teaching. In other words, countries ranking higher at EU level in terms of hours invested by teachers in collaborative activities also record the higher scores of professional collaboration and exchange and co-ordination for teaching indexes.

Figure 5.1 Overall hours invested by teachers in collaborative activities in European countries.



Source: FBK-IRVAPP analysis of TALIS 2018 Estimates obtained using replicate weights and final teacher weights provided by TALIS. Horizontal red line represents the average for EU countries.

5.3. Association between feedback, innovative teaching practices and self-efficacy

In this final sub-section, we explored professional feedback as another possible determinant of professional self-efficacy and innovative teaching practices. Feedback received from external individuals or bodies, the school management, and other colleagues may be an important source of validation of professional progress, abilities developed and of information for future professional growth. The TALIS 2018 questionnaire allows us to explore two dimensions of professional feedback: the number of different sources of feedback and the diversity of types of information usually provided by each source. Specifically, the question asks if various information types have been used to provide feedback to the teacher by the following sources: (i) external individuals or bodies, (ii) school principals or members of members of the school management, or (iii) other colleagues within the school. As Table 5.2 below shows, we can differentiate by 3 sources of feedback and 6 information types. The rows of the table display the information types: observation of classroom teaching, student survey responses related to teaching, assessment of teacher content knowledge, external results of students, school-based and classroom-based results and self-assessment of teacher work. For each of different information, teachers can receive feedback from different sources or actors. Hence, columns of the table display, for each information types, if different actors (external individuals or bodies, school principal or member(s) of the school management team and other colleagues[13]) use that type of information to provide feedback to teachers. We notice that (Tab. 5.2) feedback from the school management is the most common for all feedback types, followed by the feedback from colleagues. Receiving feedback from external individuals or bodies is more frequent than feedback from other colleagues only with respect to feedback regarding the external results of students.

13 If teacher has never received the feedback is omitted from table 5.2.

Table 5.2 Distributions of information and sources of feedback. Percentages.

	External individuals or bodies	School principal or member(s) of the <school management team>	Other colleagues within the school
Observation of my classroom teaching	23.34	49.85	35.47
Student survey responses related to my teaching	8.04	29.33	18.58
Assessment of my content knowledge	14.70	22.32	17.09
External results of students I teach	22.04	37.59	16.18
School-based and classroom-based results	11.16	47.09	29.83
Self-assessment of my work	6.80	22.60	14.28

Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

For the purpose of the regression analysis we computed two sets of variables. The first set refers to the different sources of feedback, and for each source it sums up the various types of information used to provide a feedback. As a result, the 3 variables of this set will vary from 0 to 6. The second set, indicates for each information type, the number of sources from which the teacher received feedback, thus taking on values from 0 to 3. We ran separate specifications with each set of variables to avoid collinearity[14] issues and simplify interpretation (Tab. 5.3).

Table 5.3 Estimated coefficients of linear regression models using as outcome innovative teaching practices and, professional self-efficacy and as main covariates feedback variables.

	Innovative teaching practices		Professional self-efficacy	
Feedback external (0-6)	0.040***		0.060***	
Feedback principal (0-6)	0.081***		0.073***	
Feedback colleagues (0-6)	0.023***		0.020***	
Number of feedback sources by type (0-3):				
• Observation of classroom teaching		-0.008		-0.012
• Student survey responses		0.044***		0.051***
• Assessment of content knowledge		0.069***		0.102***
• External results of students		0.037**		0.070***
• School based and classroom-based results		0.035**		0.024*
• Self-assessment of teacher's work		0.146***		0.081***
Teachers characteristics	X	X	X	X
Schools characteristics	X	X	X	X
Country fixed effects	X	X	X	X
R2	0.119	0.117	0.180	0.179
N	60877	54815	60877	54815

Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using replicate weights and final teacher weights provided by TALIS.

14 Collinearity occurs when two or more predictor variables in a multiple regression model are not independent, i.e. they are reciprocally correlated or, more precisely, one or more of them are a linear combination of other(s) predictors. If collinearity occurs, the estimates of the effects of individual collinear predictors on the dependent variable are biased, i.e. definitely unstable and unreliable. This is what happens in our case because each modality of the variable "type of feedback" is a linear combination of the number of individual feedback sources.

We first note that estimates are generally comparable for the two outcome variables. Each source of information intended to provide feedback to teachers is positively associated with the use of innovative teaching practices and professional self-efficacy. However, the estimates are larger in magnitude for feedback received from the principal or school management. Moving to the estimates on the number of feedback sources by type of information, we observe that with the exception of observation of classroom teachers, all estimates are positive and statistically significant. Receiving feedback from more sources using the self-assessment of the teacher has the strongest correlation with innovative teaching practices.

6. Summary and conclusions

The following lines present an overall picture of the basic results arrived at by the analyses presented in the previous sections of the report, ignoring – for the sake of clarity and brevity – less salient details emerging from our models. For these same reasons also the methodological and technical aspects of our study are omitted.

A convenient starting point for this short summary consists in reminding that the activities of exchange and coordination for teaching are definitely more frequently carried out by European teachers than their initiatives related to professional collaboration.

The levels of both dimensions – i.e. the values of both the additive standardised indexes we developed to measure their intensity – are affected by teachers' characteristics and – though to a lesser extent – by schools' traits.

Respondents with full-time contracts, higher levels of formal education preparedness, and societally oriented motivations when they chose their current profession display higher levels of exchange and coordination for teaching and professional collaboration, as well. Other teacher traits appear to be less influential and exert quite different effects on each dimension.

As just mentioned above, the influence of schools features on our two additive indexes are far less systematic than those regarding teachers. The incidence of students with special needs and the proportion of pupils coming from socio-economically disadvantaged backgrounds slightly enhance the levels of professional collaboration, while higher levels of school delinquency appear to push up exchange and coordination for teaching. Only the perceived level of pedagogical innovation existing in a school and the ratio of teacher to pedagogical support affect both the collaborative dimensions we studied.

It has to be stressed that, besides according to teacher and school traits, the levels of professional collaboration and exchange and coordination for teaching deeply change across EU countries. Several northern countries (Sweden, Denmark and Norway) are at the top of both distributions, while the opposite holds for Malta, Croatia, Belgium and Portugal. However, several other countries (Spain, Latvia, Italy and Hungary) record low levels for one dimension and high levels for the other one. Finally, it has to be reminded that no country records very great changes over time in the values of our indexes, that is to say in the levels of both collaborative dimensions studied.

As one can easily imagine, in light of our former remarks, some sizeable differences in the amount of professional collaboration and exchange and coordination for teaching exist not only between countries, but also within each of them. The specific measure we resorted to analyse these intra country disparities, i.e. the ICC, shows that everywhere they derive to a larger extent from within schools differences rather than from between schools variations. However, in some countries (Austria and Denmark) the between-schools differences are much

more pronounced than the ones observed within schools. On the opposite, other countries (Romania, Cyprus and Latvia) record very pronounced levels of heterogeneity among the teachers of each individual school.

After studying the levels of professional collaboration and exchange and coordination for teaching and the sources of their variations, the report has focused on the associations between these two dimensions and some other aspects of teaching such as (i) participation in CPD activities; (ii) collaboration in induction (iii) professional self-efficacy; (iv) use of innovative teaching practices; and (v) assessment methods.

Our models indicate that the overall intensity of CPD activities, as well as each of its individual components, are positively associated with professional collaboration and exchange and coordination for teaching. However, the relations with the former dimensions are always stronger than those with the latter.

Networking and collaboration with other new teachers, as well as team teaching with experienced colleagues, during induction, appears to generate an increase in the levels of professional collaboration and exchange and coordination for teaching. The effect of an induction activity carried out through team teaching with experienced colleagues is stronger than that based on the participation in networking or collaboration with other new teachers.

Teachers with higher scores in our standardised additive indexes of collaboration show stronger confidence in their pedagogical abilities and tend to be more innovative in their teaching. The results of our analyses regarding assessment methods appears to be a bit less clear. Exchange and co-ordination for teaching is positively related with the likelihood of employing every kind of assessment method. On the contrary, professional collaboration is significantly associated only with a higher propensity to provide feedbacks to students.

The report ends with three supplementary set of analyses. They regard, respectively, (i) the association between the perception of practical support received from colleagues on new ideas and the levels of teachers' collaboration and professional self-efficacy; (ii) the overall hours invested by teachers in collaborative activities; (iii) the association between the sources and the type of feedback received by teachers, the adoption of innovative teaching practices and levels of self-efficacy. The results of these analyses are as follows.

Teachers maintaining that they get more practical support from colleagues on new ideas are those displaying higher levels of collaborative activities with other teachers. On the contrary, the perceived amount of practical support received from their colleagues negatively influences respondents' convictions regarding their level of professional self-efficacy.

The number of hours weekly spent by European teachers in collaborative activities varies from about 1 hour and 45 minutes (Estonia) to roughly 3 hours and above in all Scandinavian countries (except Finland), Italy, the UK, Netherlands, Cyprus, Malta and Bulgaria. We found that countries ranking high at EU level in terms of hours invested by teachers in collaborative

activities also record large scores of professional collaboration and exchange and co-ordination for teaching indexes.

Every source of feedback positively affects, though to a different extent, the use of innovative teaching practices and the perceived level of professional self-efficacy. The same holds for the various types of feedback, except observation of classroom of other teachers.

All in all, our analyses induce to maintain that EU teachers display a sizeable propensity to cooperate with their colleagues. This propensity appears to be more pronounced when cooperation consists in the exchange with their colleagues of the results of their own professional experiences and in the coordination of their respective personal teaching activities. Instead, this cooperative propensity appears to be a bit reduced when it involves initiatives of joint teaching in the same class or with the same groups of students and joint professional learning.

High levels of both exchange and coordination for teaching and professional collaboration are displayed mainly by more professionally prepared and motivated teachers. In any case, the number of cooperative activities and experiences appear to be positively associated to the adoption of innovative teaching practices, the degree of confidence of teachers in their professional self-efficacy and the intensity of the participation in continuous professional development initiatives.

The intensity of the professional collaboration, besides teachers' characteristics, is affected – though to a lesser extent – by schools' traits. Moreover, it varies a lot across countries, that is to say according to the shape and features of national school systems. However, it has to be stressed that the variations in the levels of professional cooperation are quite pronounced also within each country. And it has to be added that in most EU countries there are more within school rather than between schools disparities in the degree of professional cooperation. Therefore, one could maintain that the professional profiles of teachers is the most crucial variable underlying the variation in the levels of cooperative teaching observed in a school and in a country.

References

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Appendices

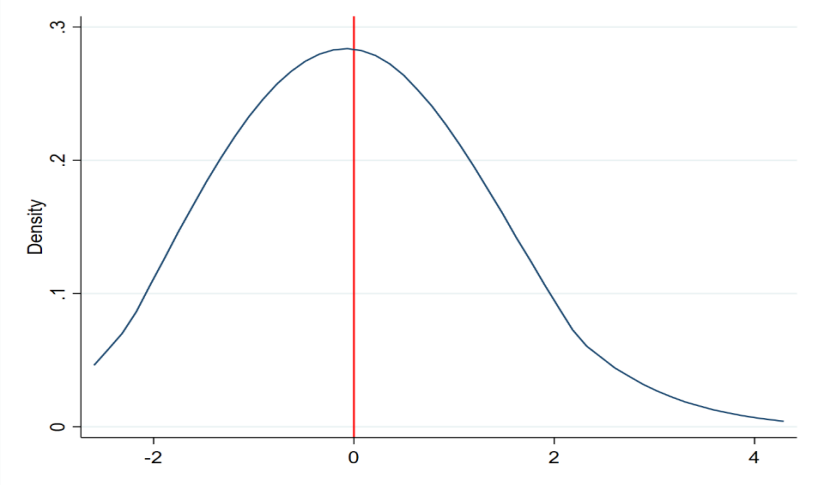
A. TALIS 2018 sample

Table A.1 Overview of the TALIS 2018 data and sample size.

	Code	Sample size		TALIS 2013
		Teachers	Schools	
Austria	AT	4255	246	
Belgium	BE	5257	302	x
Bulgaria	BG	2862	200	x
Cyprus	CY	1611	88	
Czech Republic	CZ	3447	219	x
Denmark	DE	2001	141	x
Estonia	EE	3004	195	x
Spain	ES	7407	399	x
Finland	FI	2851	148	x
France	FR	3006	176	x
Croatia	HR	3358	188	x
Hungary	HU	3245	189	
Italy	IT	3612	191	x
Lithuania	LT	3759	195	
Latvia	LV	2315	135	x
Malta	MT	1656	55	
Netherlands	NL	1884	116	x
Norway	NO	3304	193	x
Portugal	PT	3676	200	x
Romania	RO	3658	199	x
Sweden	SE	2782	180	x
Slovenia	SI	2094	132	
Slovakia	SK	3015	176	x
United Kingdom	UK	2376	149	x

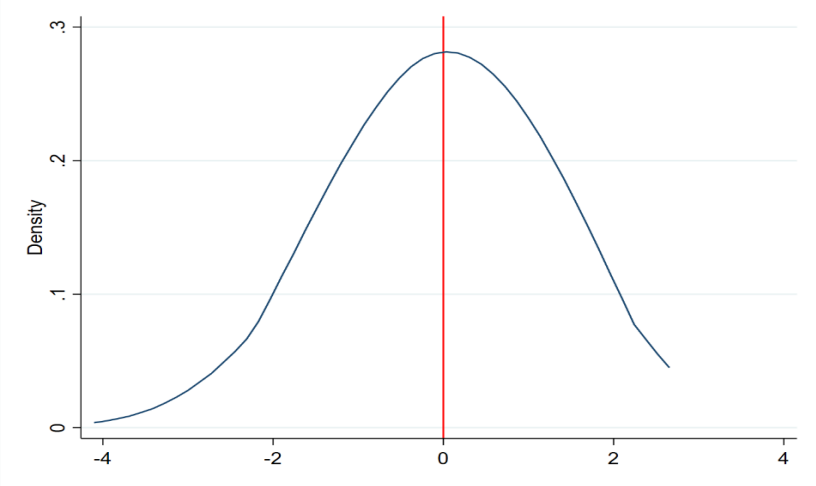
B. Kernel density of collaboration level variables

Figure B.1 Kernel density of professional collaboration index.



Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using TALIS and PISA provided replicate weights and final teacher and student weights.

Figure B.2 Kernel density of exchange and co-ordination for teaching index.



Source: FBK-IRVAPP analysis of TALIS 2018. Estimates obtained using TALIS and PISA provided replicate weights and final teacher and student weights.

C. List of variables

Table C.1 List of variables, questions and specific items from teachers' questionnaire for collaboration indexes, CPD and collaboration in induction.

Variables	Questions	Number	Item	Number
Collaboration indexes				
Professional collaboration	On average, how often do you do the following in this school? [Never – Once a year or less – 2-4 time a year – 5-10 times a year – 1-3 times a month – Once a week or more]	33	• Teach jointly as a team in the same class	a
			• Observe other teachers' classes and provide feedback	b
			• Engage in joint activities across different classes and age groups (e.g. projects)	c
			• Take part in collaborative professional learning	h
Exchange and co-ordination for teaching			• Exchange teaching materials with colleagues	d
			• Engage in discussions about the learning development of specific students	e
			• Work with other teachers in this school to ensure common standards in evaluations for assessing student progress	f
			• Attend team conferences	g
CPD				
General index	During the last 12 months, did you participate in any of the following professional development activities? [Yes – No]	22	• Courses/seminars attended in person	a
			• Online courses/seminars	b
			• Education conferences where teachers and/or researchers present their research or discuss educational issues	c
			• Formal qualification programme (e.g. a degree programme)	d
			• Observation visits to other schools	e
			• Observation visits to business premises, public organisations, or non-governmental organisations	f
			• Peer and/or self- observation and coaching as part of a formal school arrangement	g
			• Participation in a network of teachers formed specifically for the professional development of teachers	h
			• Reading professional literature	i
			• Other	j
Peer, coaching or networking	During the last 12 months, did you participate in any of the following professional development activities? [Yes – No]	22	• Peer and/or self-observation and coaching as part of a formal school arrangement	g
			• Participation in a network of teachers formed specifically for the professional development of teachers	h
Online courses/seminars	During the last 12 months, did you participate in any of the following professional development activities? [Yes – No]	22	• Online courses/seminars	b
ICT topic in CPD	Were any of the topics listed below included in your professional development activities during the last 12 months? [Yes – No]	23	• ICT (information and communication technology) skills for teaching	e
Collaboration in induction				
	When you began work at this school, were the following provisions part of your induction? [Yes – No]	20	• Networking/collaboration with other new teachers	f
			• Team teaching with experienced teachers	g

Table C.2 List of variables, questions and specific items from teachers' questionnaire for innovative teaching practices, assessment methods and professional self-efficacy.

Variables	Questions	Number	Item	Number
Innovative teaching practices				
Overall index	Thinking about your teaching in the target class >>, how often do you do the following? [Never or almost never – Occasionally – Frequently – Always]	42	• I present a summary of recently learned content	a
			• I explain what I expect the students to learn	c
			• I explain how new and old topics are related	d
			• I present tasks for which there is no obvious solution	e
			• I give tasks that require students to think critically	f
			• I have students work in small groups to come up with a joint solution to a problem or task	g
			• I ask students to decide on their own procedures for solving complex tasks	h
			• I tell students to follow classroom rules	i
			• I tell students to listen to what I say	j
			• I calm students who are disruptive	k
			• When the lesson begins, I tell students to quieten down quickly	l
			• I refer to a problem from everyday life or work to demonstrate why new knowledge is useful	m
			• I let students practise e similar tasks until I know that every student has understood the subject matter	n
			• I give students projects that require at least one week to complete	o
			• I let students use ICT (information and communication technology) for projects or class work	p
Assessment methods				
Teacher's own assessment	How often do you use the following methods of assessing student learning in the target class? [Never or almost never – Occasionally – Frequently – Always]	43	• I administer my own assessment	a
Student self-evaluation	How often do you use the following methods of assessing student learning in the target class? [Never or almost never – Occasionally – Frequently – Always]	43	• I let students evaluate their own progress.	c
Additional written feedback	How often do you use the following methods of assessing student learning in the target class? [Never or almost never – Occasionally – Frequently – Always]	43	• I provide written feedback on student work in addition to a <mark, i.e. numeric score or letter grade>	b
Immediate feedback	How often do you use the following methods of assessing student learning in the target class? [Never or almost never – Occasionally – Frequently – Always]	43	• I observe students when working on particular tasks and provide immediate feedback	d
Professional self-efficacy				
Overall index	In your teaching, to what extent can you do the following? [Not at all – To some extent – Quite a bit – A lot]	34	• Get students to believe they can do well in school work	a
			• Help students value learning	b
			• Craft good questions for students	c
			• Control disruptive behaviour in the classroom	d
			• Motivate students who show low interest in school work	e
			• Make my expectations about student behaviour clear	f
			• Help students think critically	g
			• Get students to follow classroom rules	h
			• Calm a student who is disruptive or noisy	i
			• Use a variety of assessment strategies	j
			• Provide an alternative explanation for example when students are confused	k
			• Vary instructional strategies in my classroom	l
			• Support student learning through the use of digital technology	m

Table C.3 List of variables, questions and specific items from teachers' questionnaire for the individual characteristics.

Variables	Questions	Number	Item	Number
Gender	Are you female or male? [Male – Female]	1		
Education level	What is the highest level of formal education you have completed?	3		
Type of contract	What is your current employment status as a teacher in terms of working hours?	10b		
Teacher formal education preparedness index	Were the following elements included in your formal <education or training> and to what extent did you feel prepared for each element in your teaching? [Not at all – Somewhat – Well – Very well]	6B	• Content of some or all subject(s) I teach	a
			• Pedagogy of some or all subject(s) I teach	b
			• General pedagogy	c
			• Classroom practice in some or all subject(s) I teach	d
			• Teaching in a mixed ability setting	e
			• Teaching in a multicultural or multilingual setting	f
			• Teaching cross curricular skills (e.g. creativity, critical thinking, problem solving)	g
			• Use of ICT (information and communication technology) for teaching	h
			• Student behaviour and classroom management	i
			• Monitoring students' development and learning	j
			• Facilitating students' transitions from <ISCED 2011 level 0> to <ISCED 2011 level	k
			• Facilitating play	l
Teacher formal education preparedness to use ICT	Were the following elements included in your formal <education or training> and to what extent did you feel prepared for each element in your teaching? [Not at all – Somewhat – Well – Very well]	6B	• Use of ICT (information and communication technology) for teaching	h
Teacher career choice motivation: personal or job related	How important were the following for you to become a teacher? [Not important at all – Of low importance – Of moderate importance – Of high importance]	7	• Teaching offered a steady career path	a
			• Teaching provided a reliable income.	b
			• Teaching was a secure job.	c
			• The teaching schedule (e.g. hours, holidays, part time positions) fit with responsibilities in my personal life	d
Teacher career choice motivation: societal contribution	How important were the following for you to become a teacher? [Not important at all – Of low importance – Of moderate importance – Of high importance]	7	• Teaching allowed me to influence the development of children and young people	e
			• Teaching allowed me to benefit the socially disadvantaged	f
			• Teaching allowed me to provide a contribution to society	g
Main subject taught	Into which subject category does this <target primarily fall?	37		
Work experience	How many years of work experience do you have regardless of whether you worked full time or part time?	11	• Year(s) working as a teacher in total	b
Work experience squared	How many years of work experience do you have regardless of whether you worked full time or part time?	11	• Year(s) working as a teacher in total	b

Table C.4 List of variables, questions and specific items from schools' questionnaire for the school characteristics.

Variables	Questions	Number	Item	Number
School location	Which best describes this school's location?	10		
School governance	Is this school publicly or privately managed?	12		
Schools with high level of students' language	Please estimate the broad percentage of [<ISCED level x> or 15-year-old] students in this school who have the following characteristics.	17	• Students whose first language is different from the language(s) of instruction or from a dialect of this/these languages(s)	a
			• Students who are immigrants or with migrant background	d
			• Students who are refugees	e
Schools with high level of students with special needs	Please estimate the broad percentage of [<ISCED level x> or 15-year-old] students in this school who have the following characteristics.	17	• Students with special needs	b
Schools with high level of socio-economically disadvantaged students	Please estimate the broad percentage of [<ISCED level x> or 15-year-old] students in this school who have the following characteristics.	17	• Students from socio economically disadvantaged homes	c
Class size*	How many students are currently enrolled in this target class?	38		
Innovative practices of colleagues as perceived by teachers*	Thinking about the teachers in this school, how strongly do you agree or disagree with the following statements? [Strongly disagree – Disagree – Agree – Strongly agree]	32	• Most teachers in this school strive to develop new ideas for teaching and learning	a
			• Most teachers in this school are open to change	b
			• Most teachers in this school search for new ways to solve problems	c
			• Most teachers in this school provide practical support to each other for the application of new ideas	d
School shortage of resources index	To what extent is this school's capacity to provide quality instruction currently hindered by any of the following issues? [Not at all – To some extent – Quite a bit – A lot]	29	• Shortage of qualified teachers	a
			• Shortage of teachers with competence in teaching students with special needs	b
			• Shortage of vocational teachers	c
			• Shortage or inadequacy of instructional materials	d
			• Shortage or inadequacy of digital technology for instruction	e
			• Insufficient Internet access	f
			• Shortage or inadequacy of library materials	g
			• Shortage of support personnel	h
			• Shortage or inadequacy of instructional space	i
			• Shortage or inadequacy of physical infrastructure	j
			• Shortage of teachers with competence in teaching students in a multicultural or multilingual setting	k
			• Shortage of teachers with competence in teaching students from socio -economically disadvantage d homes	l
			• Shortage or inadequacy of necessary materials to train vocational skills	m
			• Shortage or inadequacy of time for instructional leadership	n
			• Shortage or inadequacy of time with students	o
Student – Teacher Ratio	stratio***			
Teacher – Pedagogical Support Personnel Ratio	tpratio***			
Teacher – Administrative or Management Personnel Ratio	taratio***			
School delinquency index	t3pdeli***			

Table C.5 List of variables, questions and specific items from schools' questionnaire for the perception of practical support from colleagues on new ideas, overall hours invested by teachers in collaborative activities and feedback.

Variables	Questions	Number	Item	Number
Perception of practical support from colleagues on new ideas				
	Thinking about the teachers in this school, how strongly do you agree or disagree with the following statements? [Strongly disagree – Disagree – Agree – Strongly agree]	32	• Most teachers in this school provide practical support to each other for the application of new ideas.	d
Overall hours invested by teachers in collaborative activities				
	Approximately how many 60-minute hours did you spend on the following tasks during your most recent complete calendar week in your job at this school?	18	• Team work and dialogue with colleagues within this school	b
Feedback				
	In this school, who uses the following types of information to provide feedback to you? [External individuals or bodies – School principal or member(s) of the <school management team> – Other colleagues within the school (not a part of the <school management team> – I have never received this feedback in this school]	29	• Observation of my classroom teaching	a
			• Student survey responses related to my teaching	b
			• Assessment of my content knowledge	c
			• External results of students I teach (e.g. national test scores)	d
			• School-based and classroom-based results (e.g. performance results, project results, test scores)	e
			• Self assessment of my work (e.g. presentation of a portfolio assessment, analysis of my teaching using video)	f

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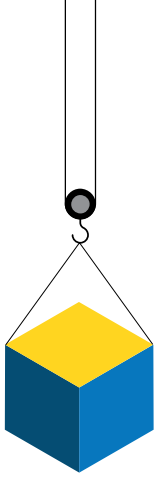

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