

## Teacher cooperation in German higher secondary schools – An explorative analysis of its characteristics and impact using science instruction as an example

### Background

Cooperation among teachers is widely regarded as one of most powerful factors for the improvement of the teaching profession at individual schools. But at least two lines of data put the general impact of teacher cooperation into question. Firstly, while qualitative data regularly stress the importance of teacher cooperation with respect to learning outcomes, quantitative empirical data often do not show a significant interrelation between those two variables.

Secondly, the degree of teacher cooperation is known to vary specifically among the different types of secondary schools in Germany. While teachers in *Gesamtschulen* (comprehensive schools) have a high degree of collaborative activity of different kinds, cooperation among teachers in *Gymnasien* (German higher secondary schools) is found to be constantly minimal. At the same time, *Gymnasien* are often found to be at least equally, if not more, effective than *Gesamtschulen* with regard to learning outcomes, even when taking the individual cognitive and familial resources of the respective student populations into account. Consequently, we are still confronted with the conclusion that the degree to which schools succeed in building coherence and consistency can only be seen “as a hypothetical explanation for the fact that some schools do better than others” (Scheerens & Bosker 1997, 108). The same authors also stress that “there appears to be no agreement on areas of cooperation that are thought to be particularly relevant” (Scheerens & Bosker 1997, 108). And as for the situation in Germany, Bauer (2004, 824) raised the question whether or not teacher cooperation in *Gymnasien* is necessary at all.

### Objectives

The first major objective of the study was to identify and portrait departments in *Gymnasien* which display a high degree of teacher cooperation. Using science teaching as an example, the respective departments were asked to provide information on the maximum degree of those aspects of teacher cooperation with a close association to the instruction process. By comparing such departments with others that have only a modest or low degree of instruction-focused teacher cooperation, an attempt was made to present data on the actual scope of the culture of departmental teacher cooperation in *Gymnasien*. The science department of some schools, termed *Fokus-Gymnasien*, were to receive an in-depth portrayal and be classified in order to showcase them as representative examples for a certain culture of teacher cooperation.

A second objective was to analyse the interrelation between the degree of instruction-focused teacher cooperation and selected output variables such as the methodological preferences of science teachers and science-related school effectiveness. Due to the non-random generation of the sample, these analyses were not sufficient for testing hypotheses

but could be used to establish well-founded hypotheses on the impact of teacher cooperation in *Gymnasien*.

#### Design, context and data sources

The study of science teacher cooperation was integrated into an extensive project which itself attempted to elucidate the impact of selected aspects of school culture on science teaching and learning. This project not only provided the scientific and organisational context of the study on teacher cooperation but also, due to its design and data sources, a major framework for the methodology.

The sample was constructed to allow for the comparison of “extreme groups” with regard to different factors and levels of school culture. A total of 16 schools were selected from two federal states, predominantly by the criteria “extent of natural sciences-related school profile”, “culture of teacher cooperation” as well as “location and catchment area of the school”. The two states, North Rhine-Westphalia and Schleswig-Holstein, were themselves selected among all German federal states based on to the different levels of significance attributed to science teaching and different levels of students’ science-related competence as shown in PISA 2000. With regard to both aspects, the latter federal state performed better than the former.

A priori data on the culture of teacher cooperation were acquired by an analysis of the school agendas of candidate schools as well by as an expert inquiry via email. In total, four of the sixteen schools, identified as Gymnasium 3, 4, 7 and 14, were expected to have a high degree of teacher cooperation in comparison with the rest of the sample.

Results are based on data from 1.157 students, 436 teachers and the principals of the 16 *Gymnasien*. The student cohort comprises all students of the schools’ ninth grade. The cited figure of teacher surveys adds up to a return rate of 48%. For the science departments, a decisive prerequisite (quorum) for the integration into the study on teacher cooperation discussed here was a participation rate of at least 50% of the teachers. This precondition was set up in order to guarantee a minimum degree of appraisal of departmental teacher cooperation. As a consequence, five schools had to be excluded, leaving a total of eleven science departments to be investigated. The average return rate of these eleven departments was 67%.

Empirical data were obtained from several sources: Firstly, an extensive teacher questionnaire to establish a department’s modus operandi with regard to instruction-focused teacher cooperation as well as selected instructional preferences of the participating teachers. Secondly, a questionnaire for the schools’ management to ascertain relevant school context data, e.g. on the schools’ science-related profile. Thirdly, a paper and pencil test based on TIMSS-items for ninth grade students, a short test on individual cognitive abilities as well as a questionnaire on familial background data to determine science-related school effectiveness on the basis of a school’s divergence from expected values.

#### Results and impact

The analysis of the teacher questionnaires reveals that in all of the eleven science departments *common work* on the departmental level is regarded as *constructive*, i.e. sufficiently effective and goal-oriented. Only two departments attain an average rating while all others lie within a positive range.

Two rather activity-oriented constructs, however, have a fairly low priority. *Cooperation on general instruction related issues* as well as *cooperation on aspects related to the didactics of science teaching* therefore have to be considered as being “rather not” a part of the collaborative culture within the science departments of *Gymnasien*. Since there are significant differences among the departments, though, it should be kept in mind that levels of common activity do vary rather than interpret this result as being uniquely low.

Again a rather positive conclusion has to be drawn for the *impulses regarding the didactics of science teaching* that teachers receive from their colleagues. In sum, these impulses are considered as being “rather helpful” to “very helpful”. This result underlines the notion that interaction with colleagues may well contribute to the professional status of teachers. However, there are also significant differences among the departments, which points to the fact that helpful impulses are not to be taken for granted as an output of common work.

Since *collegial impulses regarding general didactical and pedagogical issues* are rated as being less helpful in comparison with the above mentioned *impulses regarding subject-specific didactics*, the conclusion can be drawn that matters of communication among science teachers have a different emphasis. Because the *collegial impulses regarding general didactical and pedagogical issues* do not on average reach a balanced appraisal, the study points out the need to selectively broaden the intra-departmental culture of teacher cooperation with regard to the respective issues.

Asked to look ahead, teachers expressed the wish for *more helpful collegial impulses* concerning *subject specific didactics* as well as *general didactics*. Since at the same time, they do not want to increase their level of activity, it has to be concluded that teachers want to enhance the quality of their cooperation without actually increasing the quantity, i.e. the amount of projects and meetings.

The analyses of correlations clearly underpin the notion that increased activity with regard to instruction-focused issues goes together with more helpful collegial impulses.

Likewise, most constructs on instruction-focused teacher cooperation are positively interrelated with rather ‘progressive’ *methodological preferences* of the teachers, such as within-class grouping, and negatively interrelated with rather ‘traditional’ *methodological preferences*, e.g. teacher-centred instruction. This finding is interpreted as pointing to the fact that teacher cooperation and the preference for certain instructional concepts have a common underlying cause which can be termed as an “innovative impetus”.

Two constructs of instruction-focused teacher cooperation are found to correlate positively and relevantly with the *science-related school effectiveness* of the *Gymnasien* in the sample. The respective constructs are the *helpfulness of collegial impulses regarding the didactics of science teaching* and the *helpfulness of a common collection of materials*. Under a causal perspective this result underlines both, the relevance of a culture of mutual help and of concrete instruction-focused projects for the benefit of the teachers’ students.

Rather surprisingly, the *level of constructive departmental work* – briefly discussed already at the outset of this summary – turns out to be negatively related to *science-related school effectiveness* in the explorative study summarised here. This result is being interpreted as revealing that some loosening with regard to a constructive climate among teachers – which itself might be due to internal struggles in the course of teaching innovations or a situation of concurrence regarding the most challenging level of teaching – pays off in form of additional gains in subject-related competences by the respective students.

The two ends of the spectrum of teacher cooperation within the sample are represented by Gymnasium 3 and Gymnasium 6. The science teachers of Gymnasium 3 were categorised as *multiactive cooperators*, since for most variables on teacher cooperation as well as for the science related school profile, they performed better than most schools in the relevant areas. Gymnasium 3 turned out to be the only school, for example, where four out of five issues regarding the didactics of science instruction received at least one session of common and thorough consideration per year.

In Gymnasium 6 on the other hand, mutual assistance among the science teachers appeared to be rare. Teachers neither gave clear indications of activity-oriented preferences nor did they apparently receive helpful impulses from less technically demanding opportunities such as informal teachers' meetings. Since their non-performance with regard to teacher cooperation somewhat contradicted their fairly high degree of activity with regard to the science-related school profile, the science teachers of Gymnasium 6 came to be categorised as *ambivalent nonperformers*.

A comparative analysis of a total of five *Fokus-Gymnasien* by means of qualitative considerations showed that within two pairs, the two respective schools gained comparable levels of school effectiveness on the basis of very different levels of cooperative activities. This finding and the fact that the most effective school by far, Gymnasium 7, only showed a moderate level of teacher cooperation, put the general dependence of school effectiveness on instruction-focused teacher cooperation into question. However, a closer examination reveals that both of the least effective schools, which are Gymnasium 4 and the above mentioned Gymnasium 6, lack certain elements of common support such as a *helpful common collection of materials*. In sum, this study provides a basis for advising schools to look out for concrete and instruction-focused common support that fits their methodological preferences. It can be concluded that teacher cooperation needs an adaptation to local instruction-related needs to enhance the subject-related competences of their students.