

Researching Teacher Communities and Networks

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Abstract: In the first part of the paper I explore the collective character of teachers' experience and scrutinise the appropriateness of the concept of 'isolated' teachers. In the second part I report on 'phenomenological group interviews' as a method to study teacher communities and networks. The third part of the paper presents data of an empirical study and demonstrates how the process of interpretation can work in detail.

Kurzreferat: Im ersten Teil erörtere ich, ob und inwieweit Erfahrungen von Lehrerinnen und Lehrern als kollektiv begriffen werden können, und relativiere dabei den Begriff der Lehrperson als "Einzelkämpfer". Im zweiten Teil stelle ich das im Rahmen interpretativer Sozialforschung entwickelte 'Gruppendiskussionsverfahren' vor und positioniere es im Kontext von Lehrerbildung. Der dritte Teil zeigt detailliert, wie mit dem 'Gruppendiskussionsverfahren' vom Transkript zur fokussierten Interpretation fortgeschritten wird.

ZDM-Classification: D20

1. Focus on groups

Research questions within the field of social sciences often aim at fundamentally collective phenomena. They focus on groups of people, e.g. in research on gender, on different generations and milieu, and on the professions. The key assumption behind this focus is that the members of the respective groups have a more or less common story as far as their enculturation in that group is concerned. Their in a way similar experience allows to regard (hence, to construe) them as a group. Such a body of experience has been called "biographically collective" (Loos and Schäffer, 2001). This does not mean that the members of a group have actually experienced something together, at the same time, at the same place, but that their experience is structurally identical. Bohnsack (1993) has traced back this concept of collective experience to the work of the German sociologist of knowledge Karl Mannheim. He refers to the notion of 'interconnected space of experience' ("konjunktiver Erfahrungsraum", Mannheim, 1929/1980) indicating that thoughts and actions of people are existentially embodied in social relationships.

As examples for groups with collective experience in mathematics education, we might think of groups of students in different grades, different countries, with different gender etc. What makes their experience biographically collective? An answer to this question depends, of course, on the particular group we consider. If, for instance, we think of the learning of mathematics of the 15-year-olds in a particular country, we can, on a very general level identify a more or less common conception in that country about what 15-year-olds are supposed to do (and have done) in their families and with their peers. There may exist significant differences, but

this then is a question of scale. At least, these students are all of the age of 15 (with the characteristic problems of that age) and many of them grew up under similar social conditions. Another ingredient of their collective experience is that they all have passed through about 9 years of mathematics instruction. We could argue again that these classrooms have not been all the same, but others have even found "national scripts or patterns of instruction" (Stigler, Gonzalez, Kawanaka, Knoll and Serrano, 1999, p. 138). Thanks to national curricula, standards, nation-wide-assessment, and other attempts to make mathematical content homogeneous, all these 15-year-olds engage in the process of learning a rather similar mathematics.

2. Biographically collective experience of teachers

Is it in a similar way possible to regard teachers as groups? What is their biographically collective experience?

The structural identity of mathematics teachers' biographies is due to three issues: Culture of schools, professional autonomy of mathematics teachers, and shared fundamentals of professional knowledge for the teaching of mathematics. However, these issues do not only serve as argumentative support for the claim that teachers build groups, but they also reveal some limitations of their biographically collective experience. Hence, it will be necessary to scrutinise for which range this concept seems to be sound and appropriate.

2.1. Culture of schools

In the context of teachers and teaching, 'culture of schools' often depicts a mixture of individualism, collaboration, confirmed collegiality (Little, 1987), and also of what Fullan and Hargreaves (1996) have called "balcanization". The relative importance of each of these components, their contradictions and supplementation, is a field of study, which has received some explicit attention by researchers in mathematics education (Arbaugh, 2003; Lachance and Confrey, 2003), but approaches locate mostly within the frame of secondary in-service teacher education. However, there is evidence of the culture of a school exerting influence on new teachers. Sullivan (1989) discusses how primary teaching newcomers who have successfully tried out to teach current approaches to mathematics teaching during their pre-service teacher education programmes and who have demonstrated high levels of reflection, fall back to 'traditional' methods of mathematics instruction shortly after having been employed. As the main reason for that he identified the daily exchange of the new teachers with their experienced colleagues. Apparently, teaching staff is very effective in integrating newcomers in the prevailing culture of the school. This does not imply that new teachers do not change the school's culture at all. The process of adjustment is well reciprocal, but the power relation is highly asymmetric (Jaworski and Gellert, 2003).

2.2. Professional autonomy of mathematics teachers

The concept of autonomy has often been used in research in mathematics education as a metaphor for the

independent, individualistic, or even isolated mathematics teacher. This view is well in accordance with liberal theory (cf., Kerr, 2002). But it has been strongly criticised by feminists and other researchers that are more sensitive to social and cultural issues, recognising the importance of close personal relationships, and social relationships in general, for conceptions of autonomy (e.g., Friedman, 2000). A strong theoretical point is made by Luhmann and Schorr (1979) who do not take autonomy just as the absence of external constraints or as opposite to collegiality. Instead they define autonomy as “independence of self-regulation” (p. 52). Autonomy in their sense does not aim at a reduction of dependency. It is rather the moment when a justified choice of obligation and commitment is possible. An autonomous mathematics teacher has the freedom to make a conscious decision about the way in which s/he teaches and how s/he collaborates with colleagues. This is, of course, a culturally biased definition of the concept of autonomy. In many countries, teachers do not have the freedom to choose their style of teaching or the textbooks and assessment instruments. It is precisely both, the respective nature (or quality) of teacher education and the professional status of teachers in their societies, which make provision of autonomy possible or not. And this is part of the teachers’ common biography.

Autonomy is, following Luhmann and Schorr (1979), not the opposite concept to collegiality. If collegiality is not only an organisational-technical term for the co-existence of many teachers within one school building, but a concept that includes collaborative and mutually supportive non-hierarchical relationships, then the autonomy of the single teacher is rather a precondition for collegiality.

When teachers are reported to be individualistic and independent, this often includes that teachers are extremely careful and cautious about judging their colleagues. Generally, teachers do not interfere in the teaching of their colleagues. They do not poke their noses into the others’ classroom practices without being invited, and such an invitation is rather rare. It seems to be a common feature of the collective orientation of teachers to avoid any violation of the autonomy of their colleagues. Because of that, potentially divergent conceptions or practices of mathematics education often remain in obscurity, like a taboo topic. Without such a mechanism the professional life of teachers would display many more conflicts between colleagues, but by trying to solve these conflicts a collective conception of teaching and learning would be put forward. On the one hand, the discursive silence of teachers as far as conceptions of mathematics teaching are concerned is a shared practice; on the other hand, it disguises the seemingly different conceptions that teachers develop during teacher education and classroom practice.

2.3. *Shared fundamentals of professional knowledge*

So we might question whether there is a fundament of shared knowledge, acquired through teacher education, on which teachers ground their actions. This appears to be a question to which it is very difficult to respond and, of course, this is again an issue of scale. Ironically, many

research papers world-wide report on the deficits of the mathematical knowledge of student teachers and practising mathematics teachers, particularly if primary teaching is concerned, but also of a lack of conceptual mathematical knowledge for both elementary and secondary teaching (e.g., Gutiérrez and Jaime, 1999; Ma, 1999; for an overview, see Cooney and Wiegel, 2003). This phenomenon points to a seemingly common agenda of mathematical knowledge that mathematics teachers should dispose (and do not) and to which teacher education programmes thus should be committed. But programmes and actual teacher education practice are not always in a line. It is an open question to which degree the mathematical and methodical knowledge of graduated teachers is homogeneous even within one country. On the other hand, many countries try to develop, or already have developed, standards for teaching. Again, this will not produce a (national) common knowledge of mathematics teachers. But it will clarify in which aspects the teachers’ professional knowledge is different from other professional fields.

2.4. *Summary*

Taking the three strands together, professional biographies of teachers display to some degree what has been called ‘structural identities’. Neither does this mean that all teachers have experienced teacher education and teaching practice identically. Nor does it say that different cultures and traditions do not matter. But it allows teachers to build informal groups within their *schools*. According to Krainer (2003), such informal groups can appropriately be termed ‘networks’:

“Networks are loose and informal because there is no joint enterprise that holds them together. Their primary purpose is to collect and pass along information. Relationships are always shifting and changing as people have the need to connect.” (p. 95)

Since such networks exist, the professional biographies of teachers develop within collective reference frameworks. By that way, the individual teacher’s ongoing professional experience is loosely built in a collectively shared framework of how her or his experience is to be interpreted. What members of such networks experience in school, and in their classrooms as well, appears to be to some degree similar, firstly because it all happens in a very specific school culture. Secondly and more significantly, the collective reference framework of the networks helps to reconstruct and to interpret experience coherently. Hence, since teacher networks act and interpret their actions within collective reference frameworks, they construe biographically collective experience.

3. *Teacher networks*

Do teacher networks exist in all schools? Is there everywhere an exchange about, say, classroom experience? More particularly, is it about a mathematical classroom experience? Imagine a situation in which a network of five primary teachers are sitting around a table together with a researcher who is interested in those teachers’ everyday experience with the teaching and

learning of mathematics. Since the researcher tries to not impose her views and categories onto the situation, she starts carefully by asking, How do your mathematics classes look like? The teachers take up this question and direct their 'answers' towards the researcher – but only for a minute. They thereafter continue to report their experience to each other for more than two hours, without the researcher feeling the need to fuel the discussion. The situation has been audio-taped, but, unfortunately, on the tapes there is virtually no report of the teaching and learning of *mathematics*. The teachers have discussed very lively about some 'problematic students', about their work with the parents, about the current educational policy of the district and the headmaster and so on.

This story is a non-fictitious one, it actually happened. What does it tell us? First of all, these primary teachers have no difficulty to talk to each other. They know each other and they rely on a collective reference framework that gives them the opportunity to exchange their experience and their views without having to explain 'everything'. The analysis of the tapes reveals many instances of an indexical use of words and of what van Oers (2001, p. 68) has called "the historically developed style of communicating in that particular community of practice". Apparently, the issues the teachers discuss have been discussed previously, and what the teachers do during the discussion is adding their recent experience to their collective reference framework. This, then, is a situation of *formation* of the biographically collective experience. Through the discussion, the teachers bring their collective reference framework up to date.

Contrary to this account of biographically collective experience, teachers are often reported to work isolated from each other. Classroom doors are said to be closed (in the material as well as in the metaphorical sense), and during the time between the lessons teachers just change their teaching aids, take a coffee, and go back to the classroom. As Stigler and Hiebert (1999, p. 123), referring to Lortie (1975), put it: "Teaching in the United States is considered a private, not a public, activity." So, is this picture still true? And is it also true outside the U.S.? Stigler and Hiebert (1999) discuss extensively the example of 'lesson studies' as the Japanese way to guarantee content related discussions among teachers. In Denmark, primary and lower secondary schools provide "formal spaces of interaction among teachers by grade, class, and interdisciplinary teams, but not by specific school subjects" (Vithal and Valero, 2003, p. 562). Roeder and Schümer (1986, p. 4), summarising their investigation in the communication and co-operation of teachers in lower secondary schools in Germany, conclude that the commonsensical description of the teacher as an isolated individual is not supported by empirical evidence, and that it has to be revised.

There appears to be reason to assume that the isolation of teachers from each other is a myth, perhaps perpetuated with the goal of denying the teachers' professional status. On the other hand, empirical evidence about the time which teacher networks dedicate to the *mathematical* experience in their classrooms does not exist, either. It is not clear whether beliefs about mathematics and practices of mathematics teaching are

included in the collective reference frameworks of teachers.

4. Researching collective phenomena

The collective nature of teachers' professional orientations gives rise to doubt whether individualistic research instruments, such as questionnaires and interviews, are the appropriate means for the study of those. Where phenomena are significantly collective, wouldn't it be advisable to take the collective nature into account (Loos and Schäffer, 2001)? It may, of course, be easier to distribute questionnaires, but following Vithal and Valero (2003), maybe simple data-extraction agreements are unlikely to yield authentic information. This is not only a methodological question; it is also an ethical one. As long as we, as researchers, continue to study the single teacher as our unit of inquiry, we perpetuate the picture of the isolated teacher who is not willing to collaborate with other teachers.

The study of teacher networks, and not of single teachers, has no long tradition in mathematics education. This is partly due to the dominance of individualistic psychological theories (about behavioural or cognitive development) underlying most research in mathematics education. Nevertheless, in an editorial to one of the latest issues of the *Journal of Mathematics Teacher Education*, Krainer reports on an increasing awareness of the social dimension in mathematics teacher education. He calls for teams and project groups, but more emphatically for communities and networks of teachers as the social frames in which development of teachers (and teaching) is apparently more successful than in individualistic settings (Krainer, 2003). Whereas teacher networks generally have no joint enterprise that holds them together, teacher communities are committed to some topic.

"Communities are regarded as self-selecting, their members negotiating goals and tasks. People participate because they personally identify with the topic." (Krainer, 2003, p. 95)

It may be useful to relate Krainer's emphasis on communities and networks of teachers as promising frames for professional development to Wood's claim that we need more research about processes that are involved as teachers make changes in their teaching (Wood, 1999, p. 176). There is precisely a demand for research about processes that are involved as communities and networks of teachers change their practices of mathematics teaching.

5. Phenomenological group interview

For a method of research into these change processes made by teacher communities and networks my methodological arguments above translate into two demands.

- Firstly, the research method needs to be sensitive to the collective character of teachers' reference frameworks.
- Secondly, it needs to be exploratory, because collective teacher change is rather unknown territory.

A promising method for our purpose has been originally developed and refined for social environmentalist studies

of youth (Bohnsack, 1989; Loos and Schäffer, 2001). Although a literal translation of its name ‘Gruppen-diskussion’ would be ‘group discussion’, I prefer to introduce it as *phenomenological group interview* (PGI), thus corresponding closer to descriptions and dimensions made up in the internationally widespread ‘Handbook of Qualitative Research’ by Denzin and Lincoln (1994).

For a PGI, a group of people that rely on a collective reference framework meets, and discusses a more or less outlined topic, as a rule in the presence of the interviewer (but an audio-taping machine would principally suffice as well). Fontana and Frey (1994, p. 365) classify this as a typical field research, differentiating between natural and formal fields. In natural field research the research participants meet spontaneously, whereas in formal field research the setting is (although located in the field) preset by the interviewer. The interviewer may have suggested the topic of the PGI, but it is crucial that it is an issue within the research participants’ collective reference framework. Vithal and Valero (2003) would call it a question of “participatory validity” (p. 576) that the research participants have a stake in deciding about which topic they are going to discuss. It is the explicit goal of PGI that the group of people slips in an exchange of experience or arguments as if the interviewer were absent. This exchange may well include that the participants narrate biographically and that they complement each other’s stories. We can define PGI as a procedure in which a collective exchange process is initiated and gradually develops into a ‘natural talk’ that is usually inaccessible for researchers. The role of the interviewer is as non-directive as possible, the purpose being exploratory. However, the interviewer still has the possibility to intervene and to carefully focus the talk (according to the research interests).

As I have mentioned above, during a PGI the research participants update their collective reference framework. How can ‘update’ be interpreted? Do research participants merely utter opinions which have already been developed among them? Or is a PGI a situation of knowledge growth, of professional development? How do teacher networks learn if not by collective reflection on experience? Any answer to these questions is embedded in a theory of learning. From a sociocultural perspective, the informal meetings of teacher networks and all the more of teacher communities are precisely the loci where (collective) learning takes place. Further, if the topic of the PGI is the change of the research participants’ practices of mathematics teaching, then the PGI is highly significant for this very process of change. And this is not only so in theory. After a two hour PGI in which I as the interviewer spoke less than 100 words in total, one of the members of the participating community of teachers approached me, saying a many thanks for the fruitful and enlightening discussion.

6. Analysing PGI

Data from PGI is mostly in the format of video- or audiotape, sometimes complemented by additional observation notes. These data need to be selected, and the selected passages need to be transcribed before interpretation can

start. Needless to say, the decisions for a particular recording device as well as for the specific procedure of transcription, are based on the peculiarities of the researcher’s interest and the field in which the research is done (Edwards, 1993; Kvale, 1996; Lapadat and Lindsey, 1999).

It is only partly possible to systematically control the selection of passages for transcription. At least three issues are connected: the theoretical sensitivity of the researcher, the definition of the research questions, and the topical course of the PGI. It is well established within exploratory research that categories and concepts are not developed before data analysis. However, concepts and generalisations do not simply ‘emerge’ from the data. Data does not speak for itself, independent from the researcher. Researchers always ‘read’ data through the lenses of their theories and they reflect on the data by respective concepts. To decide which part of the data to transcribe, and which not, requires such a reflection (Kelle and Kluge, 1999). During that reflection, the research questions gain in accuracy, because the theoretical perspective of the researcher becomes connected with the empirical data. To be able to formulate accurate research questions is already a success within exploratory studies.

At that early moment of the research process, the selection of data for transcription can only be completed provisionally. It is always a constituent of the research process to revisit the original data after having interpreted the selected passages. The idea behind such a circular procedure is that the results of interpretation have sharpened the (theoretical) view of the researcher who then is able to identify more relevant passages in the original data. Thus, the perception of the topical course of the PGI is in close interrelation with the researcher’s developing theoretical perspective.

According to the researcher’s interest and the topic of the investigation, the methods of transcript analysis may vary substantially. Even if we confine us to the interpretive paradigm the situation is not much more homogenous. Of course, this lack of standardisation is an advantage, because it requires conscious adjustment of the interpretation methods to the research questions and the data. Lamnek (1998), for instance, distinguishes three methods for interpretive analysis of data that come from groups of research participants: ‘structuring content analysis’ (Mayring, 1988), ‘objective hermeneutics’ (Oevermann, Tilman, Konau and Krambeck, 1979), and ‘documentary interpretation’ (Bohnsack, 1993). It has been argued elsewhere that for the explanatory method of PGI, with its characteristically unstructured data collection, *documentary interpretation* appears to be the most fitting method (Gellert, 2003a; Lamnek, 1998). In fact, Bohnsack and colleagues developed their technique of data collection out of the theoretical framework of documentary interpretation.

Loos and Schäffer (2001) describe very much in detail four steps of interpretation, which are – for their purposes – necessary and adequate for an analysis of PGI in the theoretical frame of documentary interpretation: (1) reformulation, (2) reflection, (3) focusing, and (4) comparison.

- (1) Reformulation: Subdividing each transcript into topical units in order to identify one (or a few) overall theme/s of the transcript. If necessary, this requires a translation from the participants' language into the language of the researcher/s. Since this procedure adds something to the transcripts, this is indeed already an interpretative step.
- (2) Reflection: The aim is to identify and to make explicit as much as possible the collective reference framework of the respective research participants. For that, it is necessary to reconstruct the ways in which the research participants communicate, in which ways they refer to each other, how they collectively update their reference framework. The focus is on discursive, rather than mental activity and interpretation is at the level of interaction, rather than of mind (cf., Barwell, this volume). This may include that the participants differ in their views and in the experience they report, because such differences generally occur within groups of people. It is more important to document that the participants share a problem, that they share experience, and that they include their (even divers) perspectives and judgements in their collective reference framework. This makes it necessary to reconstruct the "development of the dramaturgy of the discourse" (Bohnsack, 1993, p. 138), that is, the formal organisation of the participants' talk. By doing this, the researcher identifies how the collective orientations of the research participants emerge through sub-processes of 'proposition' of issues, 'elaboration' of proposed issues, and 'conclusion' of elaborated issues, and whether these sub-processes occur 'interactively' or 'non-interactively'. These analytic categories (that originate from conversation analysis (Sacks, 1992)) for discursive processes may well be refined, e.g. through differentiation of elaboration: elaboration by giving an example (telling about an experience), elaboration as generalisation, or elaboration as anti-thesis.
- It might be noted here, that the linguistic analysis of the participants' talk is not our main focus of interest. Since we are interested in the research participants' collective reference framework, it is just an analytic vehicle for reconstructing the collective process of its updating. If we are in addition curious about the ways in which teacher networks and communities produce biographically collective experience, then we should pay considerable attention to the organisation of the talk.
- However, the main task of the reflection still is the topical interpretation of the participants' talk. As I have argued above, this is possible only through the theoretical lenses of the researcher. Interpretation of transcripts requires horizons of comparison, and these are provided by the theoretical perspective (and theoretical sensitivity) of the researcher. As the interpretation of data continues, the theoretical perspective of the researcher develops, and the horizons of comparison turn gradually from external to internal ones (Strauss and Corbin, 1990).
- (3) Focusing: This step tries to condense the reflective interpretation. If possible, a key issue or a crucial

point is to be identified. Those lines of the transcript, in which the research participants interact most vividly or where the talk is particularly metaphorical, often point to the collective problems or to situations that the teacher network or community could not yet grasp with satisfaction. The collective efforts to update the collective reference framework are evident in these lines.

- (4) Comparison: Although comparison between different transcripts occurs already at the reflective interpretation step, this is now the moment to compare systematically: between different teacher networks and communities (= confronting two collective reference frameworks), and between different transcripts from one group (= specification and limitation of one collective reference framework). The final aim of systematic comparison can be the generation of a typology. Such a typology is the attempt to understand and to reduce the complexities of reality by a system of empirically substantial concepts. How this can look like not only for PGI, but in interpretive research in general, is extensively described by, e.g., Bohnsack (1993), Kelle and Kluge (1999), and Strauss and Corbin (1990).

Before we are going to have a look at how some of these steps work in the research on teacher development in mathematics education, let us remember that Bohnsack, Loos, Schäffer and colleagues have developed this procedure for a social environmentalist study of youth. It may well be appropriate to modify the procedure when working with teacher communities and networks.

7. Analysing teacher change through PGI

In the terminology of Krainer (2003, see above) Mrs. Sare, Mrs. Till, and Mrs. Wosch (pseudonyms) can be considered somewhat between a network and a community of teachers. They work in the same school (an ordinary primary school in Berlin) and teach, among other things, mathematics for second grade. They invited me to visit their classes and to reflect afterwards on recent developments in mathematics education. They agreed in taking part in a PGI about their experience with a 'new' didactic approach to the teaching and learning of primary mathematics (represented by a promising textbook). This meeting took place in December 2000.

The context of the very short transcript, which I am going to analyse, is the issue of efficacy of the didactic approach as long as active-explorative learning of both the high and the low achieving students is concerned. Whereas the three teachers sum up that the new textbook facilitates mathematical explorations for the high achievers, they agree as well that this is not the case for the low achieving students, the reason for that being varying stimulation and encouragement from the parents during the pre-school years.

Transcription key

- 1st column: Utterances numbered consecutively.
 2nd column: Names of the teachers that are talking. The arrow '➤' in front of a name indicates overlapping of utterances.

3rd column: Contains verbal utterances and paraverbal information:

- / Raising of voice
- \ Lowering of voice
- . Break with one second of duration
- (laughs) | | Paraverbal information with specification of beginning and end
- (unintelligible) Passage cannot be reconstructed from the audio data

Remark

The original transcript is in German, and the original work with the data (e.g., all interpretations) was done in German. Translation of the transcript into English is already an interpretation, because translation would not have been possible without transcending the sense of the single words in the context of the PGI.

7.1. The transcript

1	Mrs. Sare	maths is still simpler in the beginning because the motivation is different from the motivation in German for example in the beginning in my view precisely in the beginning of the first always is maths they like maths more because they already know much
2	› Mrs. Till	really /
3	Mrs Sare	or really many children know much
4	› Mrs. Till	no (unintelligible)
5	› Mrs. Wosch	no no no don't think so either
6	Mrs. Sare	no /
7	Mrs. Wosch	because they fundamentally want (unintelligible)
8	› Mrs. Till	the motivation to learn this reading and writing it well is extremely high
9	Mrs. Wosch	and they want to calculate and one actually says in the beginning we don't calculate yet \ now we first exercise writing numbers and laughs we make bits and pieces well
10	Mrs. Sare	yeah this is also always yeah yeah
11	› Mrs. Till	I think this is always the problem with maths
12	Mrs. Wosch	and this was essentially better in the in the book just there that there one not just until six and then that's
13	› Mrs. Sare	(unintelligible)
14	› Mrs. Wosch	all for today and further we can't yet amused and we are not yet allowed and so on
15	Mrs. Sare	yeah I also did like this pretty well this . this this approach
16	› Mrs. Till	yeah

7.2. Reformulation

The overall theme of the transcript: The 'new' didactic approach is corresponding to the high level of motivation of school beginners to learn to calculate.

1: With the school beginners, mathematics is still simple. This is due to higher levels of motivation in mathematics than in German language classes. School beginners like mathematics, because they already know some mathematics.

2-6: The statement raises doubts.

7 and 9: The school beginners are highly motivated to calculate. In the mathematics classroom, though, teachers start with them to exercise symbolic representation of numbers. The teachers do not consider this mathematical activity as really serious.

8: The motivation of the students to learn reading and writing is as high as their motivation to calculate.

10-11: There is a general problem with mathematics

education.

12-16: The new textbook is different. It does not break the mathematical content into excessively small units.

7.3. Reflection

1, proposition by Mrs. Sare: Mrs. Sare's claim that mathematics is still simple with the school beginners does not make explicit, in relation to what? Perhaps she refers to the teaching and learning of mathematics in the later years, but it is also possible that she compares mathematics with other subjects. The latter alternative is supported by a comparison with the motivation of students in German language classes, which is reported to be lower. As the reason for the higher level of motivation for, and of more enjoyment of, the learning of mathematics, the previous knowledge of the students (acquired at the family home and in kindergarten) is mentioned.

2, *antithetic elaboration by Mrs. Till*: Although it is not clear to which single claim Mrs. Till refers, she voices her doubts about Mrs. Sare's proposition.

3, *elaboration by Mrs. Sare*: Mrs. Sare regards Mrs. Till's opposition as referring to her own last argument that school beginners are already equipped with considerable mathematical knowledge. She mitigates this argument by restricting it to many, but not all, children. Mrs. Sare's discursive strategy can be called an attempt at "repair" of her previous argument (Schegloff, Jefferson and Sacks, 1977), trying to generate a collective orientation.

4–6, *interactive elaboration by all participants*: Mrs. Till and Mrs. Wosch reject this attempt at repair, apparently because it did not respond to their doubts. Mrs. Sare continues by requesting an explanation for that.

7–9, *interactive elaboration by Mrs. Till and Mrs. Wosch*: Nearly at the same time, both teachers start to elaborate on their rejection. The rejection is related to the claim that the school beginners are keener on learning to calculate than on learning to read and write. And, even worse, in the beginning of the first year mathematics education the topic is not calculation but symbolic representation of numbers.

10–11, *interactive generalising elaboration by Mrs. Sare and Mrs. Till*: Mrs. Sare and Mrs. Till validate the last argument and declare it a general problem in mathematics education, although it is not made explicit what this general problem consists in. However, by means of this validation the teachers reaffirm their collective reference framework.

12–14, *proposition by Mrs. Wosch*: Mrs. Wosch concludes this issue by coming back to the topic of the new textbook. She initiates the argument that teaching with the new textbook is essentially better as far as the (until here not explicitly put) general problem is concerned. Apparently, the new textbook deals with calculations from the very beginning of the first school year on, and it does not use artificial domains of numbers like the numbers from 1 to 6.

15–16, *interactive conclusion by Mrs. Sare and Mrs. Till*: Mrs. Wosch's proposition is reconfirmed and it is added that this is not merely a question of a new textbook, but of a whole didactic approach.

Formal organisation of the talk

This reflection of the transcript has shown that a collective reference framework is not just the sum, or the common denominator, of some individual opinions. Although the discussion is characterised by opponent views (in 1–6), the three teachers succeed in transforming their initial disagreement into a mutually accepted conclusion. Therefore, the formal organisation of that piece of transcript might be labelled 'antithetic', and not 'conflicting'.

7.4. Focusing

The confrontation of a traditional practice of teaching first grade mathematics with the mathematical knowledge and interest of school beginners can be interpreted as the core topic of the transcript. It is very interesting to see how these teachers update their collective reference

framework. Although they initially seem to disagree about the importance of the school beginners' mathematical knowledge, in the end they, as a community of teachers, conclude that a key quality of the new textbook is that it does not atomise the mathematics curriculum into a sequence of objectives. The 'new' didactic approach gives the teachers more freedom (and, thus, more responsibility) to adjust the mathematics classes to the curiosity and the mathematical knowledge of the students. It is precisely by means of the PGI that this community of teachers includes their reflection and generalisation of their individual experience with the new textbook into their collective reference framework.

7.5. Comparison

Generally, comparison requires more than one single transcript. According to Brandt and Krummheuer (2000, p. 223) understanding of any episode or section of a transcript is always based on comparison with interpretations of other sections of the data (cf., Jungwirth, this volume). Hence, comparison is not straightforward in the sense of a linear process. Comparing data is essentially an activity, which connects the pieces of data to each other. It stimulates and controls the interpretation process (Kelle, 1994).

Since analysis by comparison has already received considerable attention in the literature on research methods (e.g., Bohnsack, 1993; Kelle, 2003; Strauss and Corbin, 1990) and is demonstrated in detail by Brandt and Krummheuer (2000) for research in mathematics education, I stop my interpretation of the transcript here.

In the following concluding paragraph, I am going to reflect on the way, in which the interpretation has been done, and whether the method is appropriate for inquiry into teacher change. For results of the research project from which the data has been drawn, see Gellert (2003b).

8. Reflection on PGI-analysis

Reformulation is programmatically different from reflection, since the interpretation of the first tries to stay close to the transcript. Although reformulation is already an interruption of the discursive flow, it is intended to link the text as little as possible to the particular research questions of the researcher. A complete disconnection is principally not possible (and not desirable, either), because phrases such as 'motivation in German' (line 1) may be attached with different meaning within research in other academic domains. Sense-making of transcripts is based on specific (theoretical) perspectives, hence the reading of transcripts is always 'contaminated' by the point of view and the research interest of the reader. This is particularly so for the division of the transcript into units of one or more lines.

There seems to be ample variance among researchers about how to document reformulation. Loos (1999), for instance, proceeds in a way, which is similar to the interpretation of the transcript above. By contrast, Schäffer (1996) is much shorter; he merely drops headings to a couple of (connected) lines. As those headings rather structure than reformulate the transcript, they disguise the process of sense-making of the research

participants' talk. From the researcher's point of view this may be regarded as an advantage, because this procedure guarantees a clear distinction between the transcript and its reformulation. It is often not easy to decide, which phrases to re-word from the transcript into the language of the researcher – without already giving a specific meaning to the text – and which not. However, since sometimes the talk of the participants appears to be confused, that is, elliptic, indexical, interrupted, the reformulation makes explicit how, on a first level of interpretation, the talk is understood. Needless to say, there are many possible understandings for each utterance. Through reformulation researchers commit themselves to the (according to their view) most plausible reading.

It is a theoretical assumption of PGI interpretation that the data originates in the talk of persons who share a collective reference framework. This is crucial, since otherwise it would be far more difficult to decide whether a discussion is opponent or antithetic, or whether there is any shared view at all. It is important to know that Mrs. Sare, Mrs. Till and Mrs. Wosch consider themselves as a kind of network or community of teachers who now and then share their experience with the new textbook. It implies that they are willing to collaborate with each other and to take the other's experience and judgement into account. This theoretical perspective on teachers' talk suggests that a PGI is not just a setting for doing research, but also a space for professional development. Of course, talking is not teaching. But if we agree that a development of instructional practice is paralleled by a development of professional knowledge and commitment, or as Tirosh and Graeber (2003, p. 673) put it, "changes in beliefs and changes in practices occur in a mutually interactive process", then to witness the development of a collective reference framework means to witness professional development.

In that sense, PGI has a potential for both the research in and the support of collective professional development in mathematics education.

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