Parents' Views on Mathematics and the Learning of Mathematics - *An Intercultural Comparative Study*

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Abstract: This paper describes an empirical study of how parents variously view mathematics and the teaching of mathematics. Based on the assumption that specific familial circumstances have a decisive effect on the procedures pupils adopt when dealing with mathematical content, the focus is on the perceptions and attitudes of parents from differing social and cultural backgrounds. The study covers parents who have immigrated to Germany as well as indigenous German parents. This paper, which reports on an ongoing study, includes a description of the theoretical framework (based on findings from educational research of immigration and on research done on mathematical didactics) as well as a description of the methodological approach employed. It concludes with a presentation of first findings from the evaluation of the interviews conducted with 'resettler' parents from countries of the former Soviet Union.

1. The focus of this study

Pupils' home circumstances carry over into the classroom: the specific home situation of children and young people is often cited by teachers as an explanation both for academic performance as well as for problems that may arise. This applies especially to immigrant families. Frequently, perceived deficits are attributed to national or ethnic origins, or to a supposed inability of the parents to impart to their children the basic knowledge and skills expected by the school. Although teaching in schools is, as a rule, guided by a desire to consider the individual experiences of the children and young people, often a discrepancy (and source of conflict) is felt between the real life of their families and the form and content of the education offered in the classroom. The multiculturalism and bilingualism of many children do not appear to be readily reconcilable with institutional requirements, with the result that these aspects are regarded as barriers to integration, rather than as useful resources and skills.[i]

Numerous empirical social scientific studies have investigated and confirmed the importance of the home as the place that provides the basis for success at school (for a detailed overview see Büchner 2003). Studies on related themes have tended to focus primarily on access to the educational system and on academic performance and skills depending on social and cultural background. Little attention has been paid to how parents prepare adolescents for the demands of the educational system. Only recently, as a reaction to the findings of the PISA study that again documented, especially in Germany's case, the close relationship between social background and type of educational involvement, has attention been directed towards the necessity of considering the home itself as an educational site where many education-related processes occur.[ii]

The family can be understood as a social system in which skills, choices of action, and social beliefs are transmitted intergenerationally. These become the basis for learning at school. Guided by widely differing forms of thinking in relation to education and associated educational traditions, it is the parents especially who pass these basic factors on to their children in the course of daily interaction.

The study presented here deals with parental attitudes towards education in families of various cultural and social backgrounds with regard to mathematics and learning mathematics. Those educational concepts the families adhere to, and processes of education shaped by everyday life within these families, which might, from the viewpoint of the parents, influence the way their children learn mathematics at school, will be investigated on the basis of interviews.

For the study, interviews were conducted with the parents of seventh-grade pupils with a Turkish linguistic or cultural background as well as 'resettler' parents of German descent [Aussiedler] who had moved to Germany from countries of the former Soviet Union. Native German parents were interviewed as well.[iii]

Picking up arguments developed by philosophers and educational theorists of mathematics in the social constructivist tradition, who view mathematics as a product of social culture and history (e.g., Hersh, 1997; Tymocko, 1985) I work on the assumption, that parents' basic ideas of, and approaches to, mathematics may diverge widely. While this does apply to native German families from different social backgrounds, it is especially true of parents from immigrant families, in which culturally moulded experiences with mathematics, possibly acquired before immigration, may affect the socialisation and upbringing of the next generation. In analysing how parents' conceptions and attitudes relate to mathematics, this study hopes to provide insight into the out-of-school context of learning mathematics and, in particular, to enhance our understanding of the learning situation of children and young people from immigrant families.

There is even less awareness in mathematics teaching than in other subjects that attitudes, judgements and experiences acquired in various social and cultural environments may differ greatly from what is taught in the classroom, and that pupils are obliged to integrate education received at home with school education. Studies comparing different countries have shown that German mathematics lessons are particularly characterised by a "specialist understanding of theory" and by a "dominance of formula-learning and an emphasis on calculus", to the detriment of references to the real world (Henn; Kaiser 2001, p. 368).[iv] This indicates that the teaching of mathematics at school is dominated by "specialist cultures", stressing the formal, contingent (and seemingly objective) character of mathematics (cf. Prediger, 2002). It must be assumed that the prevalent perspective on mathematics as being a closed discipline prevents an awareness of the variation within the students' individual preconditions.

With its intention to reconstruct, by intercultural comparison, family practices and parents' notions and perceptions, this study lies at an interface between two

areas of research: educational theory research on immigration and (constructivistically oriented) mathematics education research. Results from both these areas relevant to the problem formulated in this paper are outlined below.

2. The family as an immigration research theme

In research literature concerning immigrant families it is assumed that children and young people in immigrant families undergo socialisation in conditions which differ from those in native German families. Recent contributions to intercultural family research recognise that these conditions arise primarily from the special situation of immigration and migration, in which family life is exposed to particular changes and challenges. Immigration is understood to be a complex and dynamic process demanding many modifications to parenting approaches, involving reorientation and renegotiation of rules. In the new environment new behavioural patterns and roles are learned and relationships between the sexes and the generations within families are reconstructed.[v] The migration process is described as an interaction between host-society structures, institutions and cultural orientations on the one hand and the social practice of the immigrant families on the other.

A central finding in the literature, is that the changes families undergo as a result of migration are not universal. Several factors contribute to the different experiences of immigrant families. In her broad-based research, Herwartz-Emden (1995, 2000) focussed on the connection between gender relations and concepts of parenthood held by parents in resettler families from Eastern Europe and Russia and those of immigrant families from Turkey. Nauck, Kohlmann and Diefenbach (1997) investigated assimilation processes from the perspective of transmission processes taking place within immigrant Turkish families. Nauck's study is currently the only one in Germany to describe transmission processes in immigrant families including parents and children in Germany and Turkey. The term transmission as used in family research stems from Bertaux and Bertaux-Wiame (cf. 1991), who have reconstructed processes of social mobility covering generations in the form of family histories. In this instance, intergenerational processes of transmission relate to a broad spectrum of circumstances: to patterns of behaviour and attitudes, to values and taboos, and to a whole range of resources from communication skills to the economic resources available to families.

These studies have taken into account that the "success or failure of a migration process depends on complex, interrelated, contextually differentiated orientations, behaviours and attitudes, which in turn are related to various resources and complex interactions in various areas" (Herwartz-Emden 2000, p. 14). They have essentially helped to qualify the prevailing assumptions which have determined the way migrant families have been perceived since scientific debate began in the 1960s. Immigrant mothers and fathers attracted scientific interest mainly when their children's difficulties with integration came under discussion. As a consequence the literature was full of predominantly negative expectations of how immigration affects families (cf. Morgenroth; Merkens 1997). On the one hand, families were expected to be fragmented and disorganised, the assumption being that relationships would deteriorate. On the other hand, cultural conflicts and generation gaps were diagnosed as provoked by contact with the values system of the host society, putting strain on families. The explanation for problems which arose was a "deficit hypothesis". Traditional, authoritarian attitudes to parenting were identified as the reason why children and young people had difficulty coping both at school and outside of school. It was assumed that immigrant families regarded the preservation of their cultural heritage as their main parental duty.

These findings indicate an assumption that people belong completely or not at all to original or host society cultures – this view makes no allowance for modified or possible hybrid manifestations of culture. This position corresponds to a model of sequential assimilation; for a long time the dominant descriptive concept of immigrants' behaviour in their new home. The term refers to acculturation processes as a linear increase in integration down through the generations (cf. Esser 1980). German-language research is only slowly coming to recognise that one cannot assume a linear evolution ending either in assimilation or segregation, but that the course of integration is often best understood as a "segmented" process, i.e. there may be beliefs in certain areas that – in contrast to other areas – remain constant over a long period of time, such as Turkish immigrants' attitudes to friendship (cf. Esser; Friedrichs 1990). Findings from research into "transmigration" support this idea (cf. Gogolin & Pries 2004). In this context it has been possible to show that many immigrants cannot be unambiguously linked with one country or one language, but may well belong simultaneously to more than one community. Permanent residence in the country of immigration does not, therefore, necessarily exclude a connection to the languages, culture and traditions of the original homeland.

Research findings relevant to the conditions of socialisation and upbringing in immigrant families may be summarised thus: in principle it may be assumed that the family itself plays a special role in the process of immigration. Nauck's (e.g. 1997) investigations of Turkish families have shown that transmission processes increase in the immigrant situation: family members know more about each other and communicate more than comparable German families. In contrast to long prevailing assumptions, the families generally maintain a high degree of cohesion. Relationships between the generations are by no means characterised only by conflicts, but also by a high level of support and mutual respect. Nauck's work also indicates that family bonds in immigrant families do not hinder the integration process, but rather help overcome the insecurity often associated with immigration. With regard to parenting concepts his studies have shown that immigrant families do not present a homogeneous picture, but that their ideas and beliefs vary according to the parents' individual histories and social characteristics. Alamdar-Niemann

demonstrated that parents' educational background in particular had a decisive effect on the way they brought up their children (1991, p. 65). Better educated parents, especially in the case of the mother, tend to focus more on their children's individuality and attach more importance to the positive psychological development of their children.

In her investigation into immigrant parents' attitudes to child-rearing, Herwartz-Emden (2000, p. 113f.) comes to the conclusion that parents frequently adopt approaches to raising children familiar from their home countries, but constantly modify them critically in the light of new and existing requirements and experiences. They may not cast off their previously held, conventional attitudes to parenting, but do adapt them and change their behaviour to facilitate their children's successful integration.

These findings show that intercultural comparative studies should not try to prove the characteristics of cultural or ethnic differences assumed *a priori*, but should look for comparisons relating to the immigrants' cultural and social perception of themselves.

3. Social and cultural aspects of mathematics and learning mathematics

For a long time there seemed to be no obvious need for research projects into learning and teaching mathematics to address differing familial socialisation conditions as the context for learning mathematics in school, since the prevailing view of mathematics was (and in many circles still is), that the entirety of its formal language and methodology represents a conceptual system independent of situation or culture. Even though this idea has already been questioned, if not dismissed, the claim to convey mathematics as a clearly defined school of formal thought through which all pupils should pass in the course of their education determines the way many teachers and mathematics lecturers view themselves to the present day.[vi]

The idea that teaching and learning mathematics should fulfil a function of general education is also rooted in this claim. Familiarisation with mathematics should encourage logical thinking as a general mental skill: mathematical concepts and methods of calculation should help pupils learn ways of thinking relevant to their daily lives. For example, a key objective of the current mathematics curriculum for grammar schools (*Gymnasien*) in Hamburg is: "[Learning mathematics] develops pupils' ability to describe things from a mathematical point of view and to use mathematics actively in mastering the demands of their present and future lives." (Freie und Hansestadt Hamburg 2003, p. 5)

However, explaining the link between pupils' everyday mental activities and the internal structures of mathematics appears to be especially problematic in mathematics teaching and learning. Heymann (1996, p. 207) summarises this as follows: "The mental effort demanded in mathematics teaching and learning appears peculiarly cryptic, 'tortuous', unnatural, to those who have difficulty with mathematics, so that it is not readily accessible. It appears that one must think differently in mathematics than in everyday life." Mathematics lessons are therefore frequently held under paradoxical premises: on the one hand they claim to be relevant to life in general, even outside of school, while on the other, the focus on internal, apparently universal mathematical forms and methods often prevents lessons from coming closer to pupils' actual experiences.

Reflecting this set of problems, the cultural and social issues that pupils bring to the classroom is increasingly the focus of mathematics teaching internationally. The significance of language ability for learning processes is under consideration, especially in the context of multilingual classes (see, for example, Adler 2001). Another focus is out-of-school domains where children and young people can acquire mathematical knowledge. Assuming that they learn central ideas, norms and values in a process of mathematical socialisation some projects look at the socio-cultural practices in the parental home. These research projects document above all that school mathematics and out-of-school mathematical activities differ considerably in respect to the structures and strategies of learning processes (cf. Masingila; de Silva 2001). At the same time they demonstrate the necessity for a meaningful connection between various mathematical practices (see, for example, de Abreu; Bishop; Presmeg 2002). Whereas classroom mathematics is based on a curriculum and deals mainly with "artificial problems", striving for abstractions and generalisations and motivated by primarily extrinsic factors, in non-classroom contexts authentic, practical problems are addressed; their motivation is intrinsic and arises out of personal interest (cf. for example Street; Baker; Tomlin 2001). The difficulty of integrating mathematical skills present in ordinary life into the academic world of school mathematics has been documented: it is not possible for children's experience and knowledge to be accorded recognition in the classroom and there may be a large gap between their own and others' perception of their mathematical ability (cf. Civil; Andrade 2002). Furthermore investigations have shown that in native and immigrant families the out-of-school mathematical practice may diverge, for example in regard to the duration and intensity of parental support (de Abreu; Cline; Shamsi 2002).

4. Theoretical approach

The study reported in this paper concentrates on everyday educational processes within the family and the notions and attitudes manifested in these processes from the perspective of the parents. The focus is on mathematics and mathematics teaching. It is guided by the assumption that an intergenerational cultural transfer occurs in families – a process in which education-related perceptions and conceptions manifest themselves in the everyday life of parents and children. On the basis of interviews conducted with parents from differing social and cultural backgrounds I hope to reconstruct the mathematics-related educational content and processes which, from the perspective of fathers and mothers, play a part in the everyday family activities.

Setting the field of research in the everyday cultural practice of families directs the focus of the work at two

levels: one deals with the question *what*, in the view of the parents, is acquired and passed on, i.e. what knowledge and skills, but also what beliefs and attitudes influencing upbringing, are imparted. The other will attempt to elucidate *how* transfer processes are (consciously or unconsciously) structured from the parental perspective, i.e. how do parents direct and initiate educational processes in different family cultures.[vii]

The findings of research focussing on families document the complexity of the field. Everyday activities of families, even those from the same ethnic background, take place within a network of different sociocultural factors which may in their entirety explain education-related perceptions and modes of thinking. The significance of families for education cannot be explained by any one of these factors on its own. Rather, the framework conditions for this are multi-dimensional and cover individual, cultural, social and economic givens. In particular, the study of the situation of immigrant families requires a differentiated theoretical perspective, since the social and cultural conditions in the countries of origin, as well as the circumstances of emigration and immigration, may affect practices in everyday family life, in addition to the previously mentioned factors.

The social environment theory ("milieu") approach, grounded in Bourdieu's (e.g. 1993) theory of social practice, has proved useful in this respect for obtaining an integrative view of the various factors (for the principles of this approach, see Vester; von Oertzen; Geiling; Hermann; Müller 2001, and on family research, Grundmann; Groh-Samberg; Bittlingmayer; Bayer 2003). The theory facilitates understanding of the behavioural and attitudinal patterns of individuals or groups in the light of their social position. From this point of view parental thinking is anchored in cultural and social structures and shows itself in everyday habitualized practices. The resources available to a family at any given time represent an important pre-condition for the transmission and acquisition of education in the everyday context. The various resources available are not the focus of this study, but they are significant inasmuch as they provide an important background to parental perspectives on education.

Parental ideas, perceptions and evaluations of mathematics and mathematics education, as well as of child-rearing and conduct within the family and at school, are understood as specific resources of knowledge and experience which have a close connection to the social reality of the families. In Bourdieu's sense they may also be described as "incorporated cultural capital", which has a special status within his concept of different "types of capital" with regard to the reproduction of social structure. He describes the "transmission of cultural capital within the family" as the "most closely guarded and socially effective educational investment" (Bourdieu 1997, p. 54). In his theory the school's function is to approve the transfer of cultural capital in the family by awarding certificates. Against this backdrop, a description and analysis of parental attitudes to mathematics teaching as "incorporated cultural capital" also provides indications as to the specific preconditions for a child's success in school.

The social environment theory perspective assumes that, where the provision of cultural capital by the family is involved, parental thinking and actions pursue a "strategy" (Diefenbach; Nauck 1997, pp. 278f.), i.e. that parents' intentions are turned into educational strategies which direct their behaviour and decisions. However, practical logic is not always at the forefront. Educational objectives are not always pursued explicitly but are embedded in cultural family practices which may appear to serve quite different purposes, such as a pleasant way to pass time or maintenance of everyday customs and rituals. This also applies to mathematical practices in families. It is very likely that parents are more or less conscious of their mathematics-related attitudes, beliefs and values and that these are embedded in the transmission and acquisition of general life skills. It may be assumed that education-related everyday activities in the family have a "social purpose" (Bourdieu 1993) that goes beyond purely subjective perception. Thus educational strategies are not directly accessible, but rather, according to Brake and Büchner (2003, p. 624), can only be "surmised from present and past educational processes of those involved, their evaluation and the decisions upon which they are based."

5. The empirical study

The study deals primarily with the reconstruction of the subjective perspectives parents of differing social and cultural backgrounds have on family life with regard to mathematics and mathematics education. Based on the assumption that parents' fundamental understanding of and approaches to mathematics may vary considerably, my interest focuses on comparison of mothers' and fathers' perspectives as embedded in the specific circumstances of their lives. The complexity of the research subject of the "family" makes it very difficult to identify commonalities and differences even within one social context. It would be even more difficult to include the cultural background of immigrant families as a predetermined category in a comparative approach. The research focus is therefore directed towards identifying specific characteristics of parents' teaching attitudes. That is, the aim is to reconstruct the repertoire of experiences which may differ but which may also be shared.

Against this backdrop the research focus of this study is located on two levels. On one level the objective is to *describe* mathematical education in the family context from the perspective of the parents. This perspective is determined by the analytical separation of the *what* and *how* of intergenerational transmissions described above. In this respect the question is: what conceptions, beliefs and values direct upbringing with reference to mathematics and mathematics education? And how do these aspects affect the everyday life of the family? On the second level the project concerns itself with *contextualising* parental thinking about mathematics education, that is, to relate it to the diverse conditions determining everyday family life which are discussed in the interviews. The questions here are: what role does the cultural, linguistic and social history of the family play?

Which educational traditions manifest themselves? Which specific strategies determine parents' educational activity as described above?

Although the primary aim of this project is to delineate individual constructions of meaning, it also looks at the real-life structures within them. The individual viewpoints of the parents interviewed will be considered in their social context, i.e. against the background of structural givens, and interpreted from a theoretical perspective.

The methodological approach selected was that of guideline-supported qualitative interviews. They make it possible to focus on the subject of mathematics and mathematics education while offering an opportunity for parents to articulate the many and varied experiences they have had of this subject area. Within the thematic framework outlined in the question-prompts, the mothers and fathers can express what is important to them based on their own experience and make their own emphases with regard to content.

Interviews were conducted with the parents of 15 pupils. They consisted of three groups: 5 sets of parents from the former Soviet Union, 5 sets of Turkish-speaking parents and 5 sets of non-immigrant German parents. Their children attended either a grammar school (*Gymnasium*) or the low level courses at comprehensive school (*Gesamtschule*).[viii] Since the sample included three mothers raising their children alone a total of 27 interviews with parents were conducted. As a rule, the interviews took one to two hours and were conducted in the home of the interviewee. Each parent was interviewed alone. Wherever possible the spouse and children were absent during the interview. Parents from immigrant families were offered the option of being interviewed in Russian or Turkish. Four Russian-speaking parents and all the Turkish-speaking fathers and mothers took up this offer.

The guidelines for the interviews were based on the stated problem, tested in sample interviews and modified to include experience gained through those sample interviews. They include questions on the parents' experiences of schooling and learning mathematics, with reference both to themselves and to their children. In addition, the importance of mathematics in daily life and its significance to them personally and socially are discussed. Other questions relate to upbringing and the support parents give their children, and to their demands, requirements and wishes with regard to schooling and mathematics education. Questions on concrete experiences of immigration and changes which parents have experienced in relation to schooling, and in particular to mathematics lessons, form one focus of the guidelines.

The interviews with the parents followed the model proposed by Flick (1999), which he calls "episodic interviews". In this procedure interviewees are encouraged to relate experiences relevant to the stated problem of the study with reference to concrete situations and circumstances in their everyday family life. They are then asked for their subjective judgements. In this way anecdotal and argumentative presentations can complement each other and be related to each other. This procedure was deemed appropriate because, in comparison to other forms of presentation, it targets concrete experiences and the context in which they occurred. Mathematics is an area which may appear very abstract to many parents, and it seems useful to relate it to concrete events.

With regard to the interviews, the research project is currently in the evaluation phase. All the interviews were recorded and transcribed and, in the case of the Russian and Turkish interviews, translated into German. The objective is a comparative evaluation of themes present in all the interview texts, rather than the sequential analysis of individual texts. Using the ATLAS.ti program, which supports qualitative data analyses, thematic codes are allocated to the different sections of text. In this way the empirical material can be sorted according to theme. Through a process of increasing abstraction, coded passages of text are constantly being compared and reordered, whilst the codes employed are combined under generic terms.[ix] In the course of this categorisation there emerge those aspects which are of particular importance for the formulation of the questions, and these are then included in an overall comparative evaluation of all the interviews. Although a strictly sequential analysis of the transcripts is not performed, all the textual passages included in the evaluation are viewed within their textual context.

6. Parent's views on mathematics and the learning of mathematics – first findings

The first step of analysis in my work aims at a reconstruction of the various notions of and attitudes towards mathematics and the teaching of mathematics. Following this I turned to the question of regularities and patterns in the data corresponding with the linguistic origins of the families. A comparative survey of all interviews showed systematic differences between the groups of origin involved. There are also, however, visibly differing views within the groups.

In the following section, I will present first findings regarding resettler parents. Within this group no regularity could be found concerning the notions of mathematics. However, the situation of immigration is a shared condition with an influence on the way experiences with mathematics are perceived. Common grounds closely connected to the situation of migration come to fruition regarding the perceptions and expectations connected with the teaching of mathematics. First I will show how the parents unfold their view on mathematics in this situation and how these views are realized in the mathematical education of their children. I will then give an account of their attitudes and expectations concerning the teaching of mathematics. Drawing on this material, I will consider the role of a migrant background for mathematical socialization in resettler families in more general terms.

The report presented here is based on interviews conducted with resettler parents, who at the time of the interview had been living in Germany for a period of between two and eight years. Two families originated from Russia, one family from Turkmenistan and three

families from Kazakhstan. The parents had had all their schooling in their countries of origin and, with two exceptions, their children had also attended school for some years in these countries.

6.1. Perceptions of mathematics

The resettler parents interviewed voice widely differing notions and perceptions of mathematics. They range between two positions: on the one hand, mathematics is regarded as an intellectual tool allowing one to understand the world as governed by a meaningful order; on the other, mathematics is seen as a practical tool enabling one to handle demands occurring in everyday life. In the latter case, mathematics is reduced to arithmetical procedures such as measuring and calculating. The perceptions of mathematics held by all three groups of interviewees – which also include those of the native German parents as well as those with a Turkish linguistic background – come within this range. Unlike the other groups, the resettler parents interviewed markedly refer to their own experiences with mathematics and learning mathematics which they had in their context of origin in everyday family life or at school. They perceive both mathematics and the learning of mathematics in the context of two different systems of reference: The "Then" of the Soviet Union, and the "Now" of Germany. The perceptions and attitudes of all the resettler parents interviewed are structured around the polarities of "There" and "Here", "Then" and "Now", and "Us" (the Germans from Russia) and "Them" (the Germans). Turkish and German speaking parents also voice their way of understanding in the context of their own experiences during childhood and adolescence. For the resettler parents, however, taking into account their specific situation of immigration, the reference to earlier experiences is emphasized. I will show with two examples what this aspect looks like and the various effects it can have on the mathematical socialization within the family.

Mrs Herz repeatedly emphasizes the practical value, mathematics can have when renovating or shopping. In her opinion the ability to conduct mathematical activities like measuring, estimating and basic calculations opens up scope for action in every day life:

"You learn maths to be creative in life, to be able to vary, to be able to think something up. For example I want to buy furniture in a store, but I do not have much money and cannot afford it. Then calculating is helpful. I look for the best price or build the furniture myself. If I am good in calculating, I can make something out of nothing"[x].

This notion is rooted in her childhood experience. She grew up in a German village in rural Kazakhstan. Her daily life was determined by the necessities of a rural setting. In connection with the everyday significance of mathematics she refers to her childhood experiences:

"We used to have cattle, and you need to feed them. You know, it was a real farming life. You have to do a whole lot. And that is still the same me. How many potatoes make one pound? And how many does a sack hold? And how many sacks do you need when digging potatoes? […] And that's how realistically I want to educate my children."

It becomes clear that patterns of perception acquired in her country of origin have an impact on the mathematical education of her children. In the context of her migration she went through a drastic change of living conditions (from village to city) and keeps up her original concepts ("that is still me!"). In her view, mathematics education has to be "realistic" in the sense of being 'useful in everyday life':

I always tell my kids: If you learn maths and can't use it in life at all, you haven't learnt anything."

This criterion guides her judgement of classroom mathematics as experienced by her children. She comments on German mathematicss lessons as regards the use of computers:

"At school they flit around with their heads in rose-coloured clouds. They don't view life realistically."

Concerning the teaching of mathematics too, she falls back upon her childhood experiences:

"Our teacher always gave us exercises that could be applied to real life. For example we has to calculate the size of our garden. Or we where to measure the size of a plot of land. Very tangible."

Against the background of her critical stance regarding the German teaching of mathematics Mrs. Herz considers it her responsibility to impart mathematical contents to her children. This is done by specifically confronting her children with everyday problems containing mathematics or having them solve mathematical exercises – often with the help of Russian textbooks:

Mrs. Herz: "At school there are no demands, but at home I demand that they work. […] Sometimes I spend hours in discussion with the kids. They have to sit down and work on exercises. We really get into an argument sometimes. Yes, we really argue. And then, when I win, they have learnt something in 20 minutes."

Interviewer: "And you usually win?"

Mrs. Herz: "Certainly!"

Mrs. Herz's quotations show, that the ideas she acquired during childhood, dominate her current thinking about education and are effective in her perception of the teaching of mathematics at school as well as in her own educational behaviour.

Mr. Berger, too, refers to his experiences in the context of his origin. However, the dealing with these experiences takes on a different quality. Unlike Mrs. Herz, Mr. Berger attributes to mathematics a general educational function:

"Mathematics is a fundamental subject. A fundamental subject in every respect. Even if you don't really love mathematics, you need Mathematics always and everywhere. No sphere takes up more space in the life of man than mathematics."

He especially emphasizes the importance of the subject for the professional future of his children: "We would like our children to go to university. They are more likely to study humanities. But without mathematics it won't work. At home this is a fundamental subject. There [in Kazachstan] you have to take mathematics with every subject. I tell them: You have to learn mathematics to have general education. You need that in University and

in the job." For him mathematical knowledge is necessary in order to meet demands posed by society – he refers here to the requirements of the educational system of the former Soviet Union. But apart from that for him, too, the significance of mathematics for everyday life takes a central position, as he describes with various examples.

In this context, Mr. Berger makes observations on the relationship of everyday life and the German way of teaching mathematics:

"I only enter a shop and already I have to calculate. Life is imbued with mathematics! That's why I don't understand why so little attention is paid to mathematics. I mean, so little is demanded here. Mathematics is not held in very high an esteem. Perhaps because here, you live differently. Here there are no such problems as there are at our place. There are other problems here."

It becomes clear at this point that his judgement of the German way of teaching of mathematics takes place against the background of his everyday experience in Kazackstan. From his perspective, mathematical knowledge and skills were of a different significance in his former daily life compared to what he experiences in the migration society. Mr. Berger explains this with an example:

"I have an aunt, for example. Of course she never went to school. She is almost eighty years old. She cannot read or write. But she knows mathematics. She can solve something more quickly than I can, summing up something, calculate. She had to. She had to count every copeck. Count the money for survival. And somehow that was similar with all of us. We had to calculate in daily life and that has shaped us. That is quite different from here."

In Mr. Berger's case, the notion of mathematics is being questioned, initiated by the change of living conditions in connection with migration. In the context of the new situation, he becomes aware of his former mathematical practice.

Mr. Berger experiences a radical change of his own role in the mathematical education of his children:

"We can hardly help our kids with maths. Unfortunately. It's true I can help them with general questions. And their mother can control, whether they have done their homework. But that's all we can do. We do not speak German well enough yet, if the maths homework were in Russian there would be no problem. In the past we did much more together in maths".

Not only the missing skills in the language lead to a change in educational activity. To Mr. Berger former practices do not seem self-evident anymore as he faces specific demands of the new educational system. The following quote clearly shows this:

"Well, if a teacher called me in the morning saying: 'Nikolai Ivanych, your daughter didn't do her homework.' – in the past I would have punished her severely. Here this is different. Here the system is different and I don't want to harm my children, you see?"

Although Mr. Berger is quite critical towards the German teaching situation, he modifies his educational behaviour in favour of his children's success in exactly this situation.

The examples from the interviews with Mrs. Herz and Mr. Berger show that both parents' notion of mathematical formation has been shaped within a framework of specific living situations and specific school experiences in their context of origin. In the situation of migration, they both experience that the notion they brought with them comes into a conflict with the values and practices of the German teaching of mathematics, as they experience it through the mediation of their children. For other resettler parents, this conflict is marked by a tension, where carried-along patterns of perception are modified (as in the case of Mr. Berger) or they are explicitly held up (as in the case of Mrs. Herz).

6.2. Perceptions of teaching mathematics

The resettler parents that were questioned regard the teaching of mathematics in a highly critical way. Thus they share the estimation that in their countries of origin their children had a better support in class. Some of them report that children of the same age they know, going to school in the countries these parents left, possess superior mathematical knowledge and skills. Mr. Schneider says for example:

"The maths classes here are not good. It is very bad here because the child won't develop. Not at all. Sometimes you think: Christ! The child is so grown-up already, yet it is incapable of doing the easiest everyday calculations. We had guests from Russia, from Turkmenistan, with their children. Their children think absolutely different. They can grasp things much more quickly than our kids. So we realized: Christ! How much our kids lag behind."

Some parents whose children went to school for several years in their country of origin, find that their children are unchallenged in their German mathematics classes. So Mr. Berger says:

"Here they only give very little in maths classes. The quantity was much larger, the learning program much more advanced. Here it is very little. They have a lot of time but they don't do anything in class. We have been here for two years now and the topics Vera is now working on in maths she has covered in Russia long ago. Here they are only just starting with division, with broken numbers. That's awful! At home every forth grade student can do that."

The parents name what they consider as deficits in the German way of teaching, general shortcomings by which they explain this observation. Apart from the critique regarding the "meager content", "missing basics" are often put forward. A quotation from Mr. Merten will illustrate this:

"Here they don't put across what's important in maths. […] The basics. In primary school it's the times' tables. Later, it's formulae and things like that. Maths means being able to think and calculate logically. And here they only talk about the exercises. And once they've finished talking, it's the pocket calculator that does the calculating, not the pupils. They don't do any calculating. And if you don't have a foundation, then there's no basis for you to build a theory upon."

As with Mr. Merten the reservations often refer to an unsatisfactory promotion of concrete arithmetic skills and the oral discussion of mathematical problems, which is regarded as a deviation from the essential task. Furthermore, many parents express the view that the

teaching of mathematics in Germany is not "structured" and that the syllabus is not clearly set out in advance.

Alongside views such as these, there are several commonly held convictions concerning German teaching in general but evidently ones that also apply to the teaching of mathematics. For example, "missing discipline" is a central topic of all parents. Mr. Merten sums it up as follows:

"We grew up in a stricter system. But I don't consider that a disadvantage. It's not about being caned or anything like that. But there's a lack of discipline in German schools. Fundamentally so! And this lack of respect towards the teachers, the familiar way they're addressed, this sitting on the desk."

In addition to the central topic of "discipline", the parents also maintain that "demands are too low" in German schools. This becomes manifest, inter alia, in their children not being given enough homework, as well as in the more open teaching methods used, such as project or pupil-driven open-plan work. A quotation of Mrs. Herz illustrates this:

"These homework sheets they get for the whole week. I hated them right from the beginning. I just couldn't accept and understand that. The homework for topics lie on the window sill and every child can take any of them just as they feel like and do them. And the child just fools around."

Another issue being questioned is the role of the teacher and the perception the teachers have of themselves. According to the parents, the teachers do not offer sufficient support to the pupils and "are less committed" than the teachers had been in the countries the parents came from. Mrs. Erdmann, for example, says: *"In Russia it was not a profession, it was a vocation."* The following quote from Mrs. Körber can be understood in this line:

"At our place the teachers act like they do towards their own children. Here this is not at all the case. You finish the lesson and leave. But our children are not used to this. At our place the teacher took an interest in what the children do. How do they live? How do their parents live?"

6.3. Migration as a basic condition shaping the familial approaches to mathematics

The present exposition has shown that the perspective of resettler parents on mathematics and the teaching of mathematics is especially marked by the reference to experiences brought along from their context of origin. The following will go beyond this observation and by reverting to Bourdieu's concept of "cultural capital" will look into the significance of the context of migration for the mathematical education of children. Bourdieu does not explain a successful education as an effect of natural competences, but as a result of available resources. Within this framework, the cultural capital passed on in the families constitutes an important determinant of success in school. With this background, the question arises as to which specific conditions shape the way in which resettler parents convey cultural capital (elaborated differently in each family) in the situation of migration.

The interviews give clear indications of the linking of the parents' situation to conditions concerning the economic and social position of the families. The families came to Germany subsequent to a time when considerable numbers of immigrants from the former Soviet Union had arrived around 1990. This time was characterized by growing unemployment in Germany and decreasing state support for integration. Most of them experience a lowering of their social status and they work in jobs that are beneath their level of competence. The following quotation by Mrs Schneider exemplifies some of the challenges facing immigrants in this situation:

Interviewer: "So, how do you think you can support your children in maths?"

Mrs. Schneider: "Well, sometimes I say: 'Come on, children, learn! You've got to learn if you don't want to be emptying bins or scrubbing toilets.' We all have degrees. All of us had normal jobs there. And then we came here. And who are we here? Nobodies! 'And look at your Mom. She goes charring, she cleans other people's toilets."

Interviewer: "And does that help?"

Mrs. Schneider: Maybe it helps. Of course they become thoughtful, And they understand how difficult is is and that we would rather have it differently. But we don't have any chances."

The case of Mrs. Schneider, in unison with most of the parents, documents the devaluation of educational qualifications as a crucial moment of their new situation. Using Bourdieu's words: The parents face the situation that their 'institutionalized cultural capital' (certificates of educational qualification) acquired in their context of origin, legitimizing the 'incorporated cultural capital' (education in a general sense) may not be transferred to the new context.

The example from the interview clearly shows that the parents' formational intentions and the educational activities originate in this experience. The general instruction "Children, learn!" expresses the enormous importance Mrs. Schneider attributes to education. The conveying of education, i.e. cultural capital in an incorporated form, plays a role of major importance for the other parents as well. It finds its expression in the fact that they are highly involved in the (mathematical) education of their children. I would like to refer once more to Mrs. Herz, virtually developing her own mathematical learning program for her children, or to Mr. Berger pointing out the limitations of his support concerning school tuition whilst undertaking every effort to increase the educational opportunities of his children. He sums it up as follows:

"All our efforts have to be devoted to school. They have to learn well. That is very important. […] And we help as far as we can so they can live normally. As good as everybody in Germany lives. That's why we are happy that we [our kids] are going to a Gymnasium.[…] The Hauptschule and the like are absolute trash."

Mr. Berger stresses the importance of school formation regarding the social positioning of his children in the society of the host country. He suits his is educational behaviour to the intention of facilitating a maximum of formal education for his children, even though he judges the quality of formal education in Germany rather negatively, as has been shown earlier. The example of Mr.

Berger clearly shows that not only the new everyday situation in connection with migration has an impact on the familial conveying of education, but the structure of the German educational system as well. In his thinking is reflected the capability of the educational institutions within the multi-tire educational system to either even out or increase the unequal social and economic initial conditions of families.

Seen against this backdrop it may, on a heuristic basis (given the present state of evaluation) be observed that resettler parents have not accumulated their 'institutionalized cultural capital' in their host society, which turns out to be a disadvantage when compared to native Germans. On the other hand, their educational strategies very much emphasize the value of 'incorporated cultural capital'. For the passing on of education in the families though, the structure of the school system constitutes an important basic condition.

7. Conclusion

In this paper, the question was raised of resettler parents' specific expressions of educational expectations and processes concerning mathematics. It shows that individual prerequisites and contextual conditions of the situation of migration work together in shaping the mathematical socialization of the children. The repatriate parents attribute a great significance to the conveying of mathematical education. This becomes already evident in their rather critical - compared to the Turkish speaking and native German parents interviewed in my study – position towards the German mathematics classes.

Given this background the extent to which the familial educational orientations can be used by the children as cultural capital (in Bourdieu's sense) at school is a question leading further. For Bourdieu, school is a world following its own logic, asking of those belonging to it the belief in its values and its forms of practice. The teaching of mathematics as an integral part of school follows its own functional logic as well, finding its expression for example in passed down cognitions and convictions, specific elaborations of language, patterns of behaviour and certain rules of conduct. Efforts in school didactics increasingly aim at the forging of links between the culture in class showing in these characteristics and the everyday culture. Another topic is the necessity of a stronger subject orientation of the teaching of mathematics. Nevertheless differences will remain – as the interview examples from the repatriate parents imply – between that which the learners bring along and the school mathematics they are supposed to acquire.

Given the background of the resettler parents' perspectives, it is possible to appreciate the demand on the children to integrate familial educational thinking and the (still not sufficiently questioned) "logic" of mathematics classes.

Notes

[i] The gap between school standards and actual skills has repeatedly been described and analysed from the perspective of educational science. Examples of this are the contributions of the Special Research Field (*Sonderforschungsbereich*) of the German Research Foundation (Deutsche Forschungsgemeinschaft – DFG) "Folgen der Arbeitsmigration für Bildung und Erziehung". See, for example, Gogolin; Nauck (Eds.) (2000).

[ii] The Scientific Advisory Board for Family Affairs at the Federal Ministry of Families, Senior Citizens, Womens and Youth (Wissenschaftlicher Beirat für Familienfragen beim BMFSJ) (2002), in a statement on the significance of the family in the context of educational policies, criticised that discussions of educational policy were limited to "problems of school administration and the standardisation of performance", and neglected pre-school and out-of-school educational processes. (pp. 5-9).

[iii] This project forms part of a larger research project "Mathematiklernen im Kontext sprachlich-kultureller Diversität" (Learning Mathematics in the Context of Linguistic and Cultural Diversity), supported by the DFG. The aim of this project is to investigate how pupils from immigrant families perceive and process mathematical subjects. Its propositions are grounded on the basic premise that the cultural and, in particular, the linguistic home circumstances of all pupils represent a significant backdrop to their mathematical and scientific education, although this is not adequately catered for in schools' behavioural and learning policies. The central issue of the project – possible differences between young people from immigrant families and native German adolescents in their approach to mathematics – is investigated on three levels: linguistic skills and their influence on comprehension of mathematical problems; the behaviour of pupils; and the level under investigation in this study – that of cultural practises governing family life.

[iv] The authors of the paper "Gutachten zur Vorbereitung des Programms *Steigerung der Effizienz des mathematisch-naturwissenschaftlichen Unterrichts*" also regard operating with "preconceived conceptual constructs and methods of solution" as a characteristic and fundamental problem of teaching mathematics, because teaching always strives for generalisation and conceptual reliability. They point out that "meaningful learning, in contrast, relies on the individual and social significance of the subject, with regard to target-orientation and openness to its complexity" (Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung 1997, pp. 38-39).

[v] The Sechste Familienbericht (Sixth Report on the Family), published by the Federal Ministry of Family Affairs, Women and Youth offers a summary of the complex processes linked to immigration. It also provides a wide-ranging overview of the different lifestyles of immigrant families in Germany and their position in the social structure (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2000).

[vi] For critical views of the old, aprioristic idea of mathematics cf. Tymocko (1985), Ernest (1998), and Hersh (1997), all arguing from a social-constructivist position. See also "ethnomathematical" contributions to the same question like that put forward by D'Ambrosio, U. (1985) or Bishop (1991).

[vii] Several authors have recently demanded the programmatic inclusion of the transfer process – and thus the perspectives of those involved – into research into family educational processes. Cf. Diefenbach 2000; Grundmann et al. 2003; Brake & Büchner 2003.

[viii] The composition of the sample corresponds to the design of the research project “Mathematiklernen im Kontext sprachlich-kultureller Diversität” (cf. fn. 3), of which the work presented here forms a part. The sample on which the overall project is based is composed of pupils from six different schools: three grammar schools and three from the lower sets in comprehensive schools. Two schools have a large proportion of Russian-speaking immigrant children, two have a large proportion of young people with a Turkish background, and in two schools the great majority of the children speak only German. The composition of the group of parents interviewed reflects the composition of this sample.

[ix] This procedure corresponds in essence to the method of "theoretical coding" as developed within the context of the "grounded theory" whereby "data are broken down, conceptualized, and put back together in new ways" (Strauss & Corbin, 1990, p. 57). The specific stages of "theoretical coding" as proposed in this theory were, however, not followed here.

[ixi] Underlining marks an emphasizing of the respective word.

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