RECONSTRUCTION OF CONJUNCTIVE REALMS OF EXPERIENCES IN EARLY LEARNING PROCESSES

Two theoretical Perspectives on the Process of Negotiation of mathematical Meaning

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From the socio-constructive point of view the process of negotiation of meaning is of crucial importance for the research on learning situations.
I will present analysis of learning situations that emerge in interactions within the kindergarten context. It will be introduced a situation of play and exploration within this context that is arranged by nursery teacher with children age 4 to 5 interacting on geometrical issues within the kindergarten context.
In the paper I will argue, that the research on the process of negotiation of meaning from interactionistic perspective that refers to the local productions of the interaction, needs a theoretical extension towards considerations of structuralistic and respectively socio-linguistic theories. This theoretical extension concerning learning processes is in need to mention beside situational emerging meanings as well trans-situational meanings that are reproduced in linguistic markers. As a first step the following paper for that reason focuses on theoretical considerations of interactionistic perspective and adverts through the exemplarily analyzed situation the 'blind spots' of the theoretical approaches concerning the process of negotiation. In a concluding chapter there will be examined some first considerations to bridge this gap.

PROLOGUE - FIRST MOMENTS OF A SEQUENCE ABOUT MEASUREMENT TO EXEMPLIFY THE RESEARCH INTEREST

To exemplify my research interest at first I would like to present a sequence from the empirical data that is based on a longitudinal project on **e**arly **St**eps in **Ma**thematicas **L**earning (erStMaL) at the Centre for Research on **I**ndividual **De**velopment and **A**daptive Education of Children at Risk (IDeA) in Frankfurt am Main, Germany. The project erStMaL accompanies children from age 3 during their first years in kindergarten to age 9 when they are finishing their 3rd grade in school. The project includes approximately 150 children. Within the project we implement situations of play and exploration. These situations refer to the mathematical domains of number

and operation, geometry, measurement, pattern and structures, and data analysis (concerning the five mathematical domains see for Germany: *Beschlüsse der Kultusministerkonferenz*, 2005; for Anglo-Saxon countrys see: Clements & Sarama, 2005).These mathematical situations of play and exploration are developed by the erStMaL-team (see Acar, Hümmer, Huth, Münz, & Reimann, 2011). The major interest of the research within the project deals with the relationship between the process of negotiation of meaning and the children's development of their mathematical thinking (e.g. Acar, et al., 2011; Krummheuer, 2011a).
Additionally we encouraged nursery teachers to develop and implement such mathematical situations with groups of two or four children by themselves, to observe also everyday practice in kindergarten regarding to the different mathematical domains. The nursery teachers therefore were asked to create the situations in reference to one of the five mathematical domains.
In my PhD-project, which is part of the erStMaL project, I focus on such situations implemented by nursery teachers. The focus of my research interest are sequences of interactions in daily practice situations, in which the adult and children create learning opportunities for the kids to become more self-contained within the mathematical discourse or rather develop (more) sophisticated mathematical meanings. My research interest thereby generally stands in the theoretical tradition of socio-constructivism and refers to approaches from (symbolic-)interactionism and educational sociology.
It refers to the research question how more or less active forms of participation in the process of negotiation of mathematical meaning are influenced by the impact of situational emerging and trans-situational meanings coded in linguistic markers and in which way these forms of participation are related to the process of early learning mathematics. Regarding to that question in the following paper I reconstruct interactional processes in mathematics learning concerning their structures of the negotiation of meaning and the multimodal aspects that influence these structures.
In the presented paper I exemplarily chose a scene that refers to the intended mathematical domain geometry. Here the teacher and the children deal with the mathematical concepts of size from a set-theoretical perspective.
In the following chapter I will only mention the scene descriptively to highlight the interestic parameters for my research interest. In addition the scene is interpreted with regard to the theoretical perspective later on.

And which are belonging together?

The scene takes place in the middle of a situation implemented by a nursery teacher in a kindergarten in the suburban area of Frankfurt a.M., Germany. The teacher is the attachment figure of the children and their group manager at the day care centre. Additionally she is in charge of the group of the so-called "small researchers" in the kindergarten. The children who are taking part in the situation are: Hannah (3;3 years), Michael (3;7 years), Bettina (4;7 years) und Martha (5;3 years). The materials the nursery teacher uses in the situation are: two green paper circles with different

diameters (0,5m and 1,0m), a gunnysack which is filled with ten different but pairwise similar objects in each case in two different sizes. In the following described scenes there are mentioned two nails (3cm and 5cm) and two building blocks (15x7x4cm and ca. 5x3x2cm). During the time of the sequence the children are sitting on a carpet together with their nursery teacher. To paper circles are lying on this carpet and children are sitting in a semicircle around it. At the beginning of the situation the nursery teacher asked the children to allocate the objects to the two paper circles according to their size. The children decided whether the objects are bigger or smaller as the second similar object. So in the following I will call the entire scene the 'order-relation-scene'. It takes some turns till every object is related to a circle.

After the objects are assigned towards the paper circles a second scene takes place. This scene I will be described in the following explanations of the paper through the expression 'comparing-scene'. At the beginning of the scene the nursery teacher asks the kids: "And which are belonging together?". Bettina reacts and selects both of the building bocks from the different paper circles by pointing to them with her finger. She backs that gesture by saying the indecial words "that" and "that". The nursery teacher now gives the instruction to Bettina to locate (the) objects on the edge of the carpet where they are separated from the paper circles and the other objects. She tells that they have to be located in a line. She marks with a deictic gesture the starting point of the array and the accompanying expression: "start right here".

Bettina thereupon collects a "new" object – a nail. The teacher comments that with the words: "Two things that belong together" and stresses the word "two". So Bettina takes the second nail. This action is confirmed from the nursery teacher by the expression "okay". After that she marks again the place where the nails should be placed. When Bettina lays down the nails on the marked position, the teacher corrects the position by putting the nails side by side so the nails are parallel to themselves and the carpet's edge. Additionally she confirms the successful ending of the task through her expression "Exactly. This way." and asks the kids who want to find the next objects that belong together.

In the next following scenes the kids positioned pairs of objects on the carpet in a line with the first two nails.

Sketch of positions

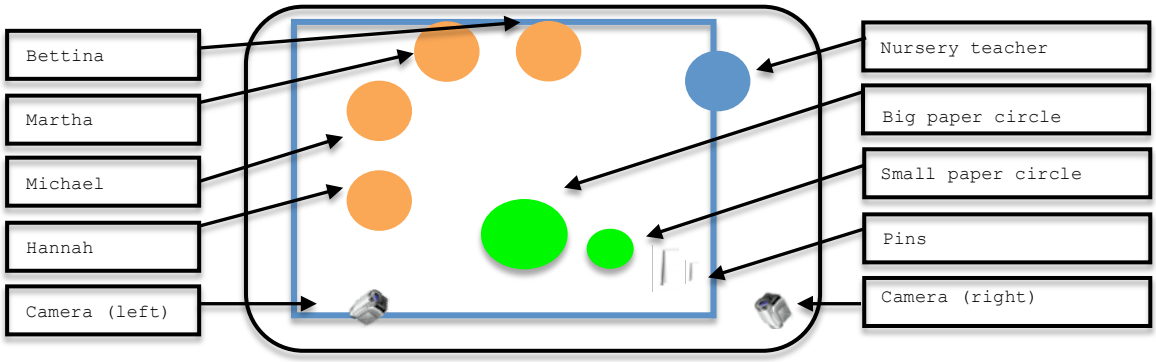

Fig. 1: Position of the children, nursery teacher and the material

Some remarks on the scene

The reason why I picked out this short scene of an interaction is my search for aspects that entail opportunities of participating in the process of negotiation of mathematical meaning. As I will show in the theoretical chapter of this paper, the structures of the process of negotiation of meaning can be effectively on the process of learning. Regarding to the findings of Krummheuer (2012) the focus on learning situations, when changes can be reconstructed[1], is of crucial importance for the research of the process of learning.

Within the presented scene the nursery teacher and Bettina accomplish a learning situation. The chosen scene opens a new interactional unit within the situation of the nursery teacher and the kids dealing with the mathematical concept of size. Here a (new) process of 'making meaning' to mathematical objects is starting. While the negotiation of mathematical meaning, the more or less sufficient mathematical background of the adult person encounters the first time the framing of the situation by the young girl concerning the mathematical topic of the sequence. In the scene the girl have been participating alternately with the nursery teacher. She 'produces' solutions of the given task. In the middle of the scene she abolishes the selection of chosen building blocks (and after that collects the nails). One can anticipate that Bettina takes the blocks after the order of the nursery teacher to put them in line on the edge of the carpet, but something seems to change Bettina's mind, so she solves the task in a different way. One could interpret the situation as a misunderstanding of the concept of classification by Bettina. Although Bettina firstly seems to choose a "correct" mathematical classification to solve the problem, she used another way to solve the problem. In the following interaction the structure of the interaction changes:

In the following paper I will focus on the change of structure in considerations of the topics:

Which emerging structures of the process of negotiation of meaning can be identified in the scene?

Which opportunities to participate are observable for the children?

[1] Krummheuer (2012) in his findings regards to situations, that he attributes with the term "something is goes wrong" (e.g. Krummheuer 2012, p. 4)

First considerations and empirical results that will give an access to the multimodal aspects that influences the process of negotiation of mathematical meaning will be presented in the further analysis of the scene from theoretical background.

THEORETICAL BACHGROUND – THE PROCESS OF LEARNING FROM SOCIO-CONSTRUCTIVIST PERSPECTIVE

In the following chapter I will introduce socio-constructivist approaches as a general perspective for the analysis of the early learning processes. I will broaden this generally theoretical perspective towards specified interactionistic approaches of a theory of mathematical learning. This theoretical background will afford the reconstruction of the development of thematically contend-related mathematical meaning within process of negotiation taken place in the aforementioned situation.

Negotiation of meaning within the interactional process

Common to the presented socio-constructivist approaches in this paper is the point of view that the process of learning is initiated by social interaction. The interactionistic theory, which is taken into account, based on the phenomenological sociology of Alfred Schütz (1979) and its expansion into ethnomethodology (Garfinkel, 1972) and symbolic interactionism (Blumer, 1969). In this regard I use the theoretical expansions of interactionistic approaches of Bauersfeld, Krummheuer and Voigt (Bauersfeld, Krummheuer, & Voigt, 1985), which takes the social interaction as a mutual exchange of individual meanings within a *locally* emerging course of action and wherein potentially processes of negotiation of meaning are initiated (e.g. Krummheuer 2012, in press). This perspective takes into account that meanings of objects within interactions are ambiguous, which means amenable for the interpretations of all participants of the interaction. Participants attain a "taken-as-shared" understanding of the objects through the negotiation of (mathematical) meaning of the object within the interaction. The developed 'taken-as-shared'-meaning of the mathematical theme which is negotiated within the interaction can perceived and interpreted differently by the participants of the interaction, so it varies concerning the individual definitions of the situation (vgl. Maier & Voigt, 1994, p. 78). It should be mentioned, that these processes of negotiation of meaning are reconstructed as locally emerging processes.

Learning in the process of interaction in early childhood

Early childhood mother-child-situations or situations between nursery teachers and toddlers in the kindergarten can be amongst others seen as the first places the child encounters mathematics in the social interaction. Within these interactions the adult and the child are acting mathematically on books, plays or other mathematics

intending material. These situations can be more or less affected by interactions wherein the adult and the child together accomplish learning opportunities. In the analysis of the interaction taken into account in that paper I access the approach of Bruner who describes mother-child-interactions regarding situations in early language acquisition. Concerning to Bruner (1983) these interactions are characterized by "supports". Support thereby is described as a system of emerging structures of the interaction, which is conducive for learning in the way that it allows the child to participate within the interactional structure and to take over increasing responsibility for the production and activities in the interactional structure over time. Bruner in this regard describes, that the process of learning starts when an adult and a child „create a predictable format of interaction that can serve as a microcosm for communicating and constricting a shared reality" (Bruner, 1983, p. 14). Within these interactions he reconstructed formats, which are standardized interactional pattern that "contains demarcated roles that eventually becomes reversible" (Bruner, 1983, p. 120). Increasing autonomy within these formats, Bruner (ibid.) argues, can be seen as a learning progress. Following the constructivist approach support has to be seen as a performance of the interactional system that is corporately created by both mother and child. In this interactional framework „shared procedures of interpretation and negotiation " (Bruner, 1983, p. 17) take place (e.g. also Bruner, 1985).

Mathematical approaches of the concept of leaning through interaction in mathematics education

In mathematics education Krummheuer (1989, 1995) points out that such formats also exits in mathematical interactions of the learning process. Just as in the findings of Bruner these supportive systems of mathematical situations are characterized by an interactional pattern. Krummheuer (1995) in that case focuses on negotiation of meaning that were related to mathematical content. Regarding to mathematical interactions the interactional pattern is related to the structure of argumentation that emerges within the interaction. Krummheuer called these argumentative patterns in mathematics situations wherein a conducive (resp. supportive) system emerge 'formats of argumentation'. Wherein these supports the participation on mathematical content-related argumentations is afforded (see Krummheuer, 1995, p. 253f.).Within the mathematical format of argumentation there emerge opportunities to participate for the child, which are given by the structure and the repeating of the format. Brandt therefore adopts the concept of the "leeway of participation"[2]. From Brandt's perspective a leeway of participation can be seen as a potential, which affords specific forms of participation. Brandt empirically reconstructs different kinds of a leeway of participation by analysing the structures of participation and the emerging potentials for children concerning a more or less active participation within the interactional process. The child individually utilizes the leeway of participation that is

[2] See the notion of „Partizipationsspielraum" in (e.g. Bart, Yuzawa, & Yuzawa, 2008) that is translated into English as „leeway of participation"; see also and (Brandt, 2004).

interactively accomplished. Depending on which potentials emerge within the interaction the child is permitted to be a creator of new aspects or paraphrases previous contributions (active) or be in the status of a bystander or monitoring the situation. It should be mentioned that these varies of participative profiles constitute in their mutual exchange the structure of participation within the interaction itself. Over time the child more and more takes over responsibility and activities in the interactional process and this way might codetermine the modification of the structuring process of the interaction. This way also conditions for a support of collective learning are constituted (e.g. Brandt, 2004). The development of the child from this interactionistic perspective is not seen as a general individual progression, respectively, the child discovers (new) mathematical meaning by co-constructing it.
This interactionistic perspective from mathematics education (given by Krummheuer's approach of the 'format of argumentation' and Brandt's remarks on the 'leeway of participation') on supportive mathematical systems of interactions can examine the relationship between the participation of the children in mathematics interactions with the nursery teachers and the individual content-related learning of mathematics. This approach so far seems to be appropriate for analysing the empirical data with regard to the research purpose given by the introduced questions of this paper.

Methodological approach

To survey the complex structures of the supportive system of the introduced scene I will reconstruct the process of negotiation of meaning form perspective of interpretative research[3] in reference to five structuring dimensions, which helps to describe the complexity of the ongoing process. These dimensions are firstly introduced by Brandt and Krummheuer (2001) and took into account within approaches on interactional processes by Krummheuer and Fetzer (2005). Here I will mainly focus on the three of these integral dimensions with regard to the implemented theoretical topics of this paper: the development of the mathematical theme, the accounting practice and participation. For the reconstruction of the development of the mathematical theme I methodically refer to interactionstic analysis, which refers to the interactional theory of learning (Cobb & Bauersfeld, 1995). The method was devised by a working group round Bauersfeld in reference to ethno-methodological conversation analysis (Eberle, 1997; Garfinkel, 1967; Sacks, 1998; Strauss, 1994). It will focus on the reconstruction of the meaning and the structure of interactions which emerge locally within the interaction (e.g. Krummheuer, 2011b) .

Additionally I will add some remarks on the process of argumentation by analysing the accounting practice within the interaction. Therefore I will utilise the

[3] For the characteristics of this methodological perspective see Bohnsack (Bohnsack, 2007) and Krummheuer (2007)

argumentation analysis of Toulmin (1969). To mention also the opportunities to participate in the interactional process of negotiation and the argumentation I will apply to the concept of the 'leeway of participation' developed by approaches of Brandt (2004) and also Krummheuer & Brandt (2001)[4].

Because of the limitation of space in this paper, in the following I will restrict the elaborated analysis of the sequence to its major topics, which help to understand the content related negotiation that is taking place in the interaction and mark the argumentative process within.

ANALYSIS OF THE INTRODUCED SCENE 'COMPARING'

Transcript

001	N. :	And which are belonging together/
002	Bettina:	*knuckles down to the paper circles* That one\ *pointing with one finger*
003		*at the big wooden cuboid which is lying on the big paper circle* and
004		that one *pointing at the smaller wooden cuboid on the smaller paper*
005		*circle*
006	N. :	Take a look Bettina (.) put two things together\ here we make a line
007		*pointing with her finger in a line right beside the paper circles*
008		*parallel to the edge of the carpet* start right here\ *pointing at one point*
009		*near the edge of the carpet*
010	Bettina:	*takes the smaller pin from the smaller paper circle*
011	Michael:	laughs
012	N. :	Two things that belong together\
013	Bettina:	*takes the bigger pin from the bigger paper circle*
014	N. :	Okay\ take a look\ one here\ *pointing with her finger to the same point*
015		*she marked before* and one here\ *pointing at a place a little bit more*
016		*on the left hand side next to the place she marked before*
017	Bettina:	*placing the bigger pin to the place that is marked second and the*
018		*smaller pin to the place that is marked first by the nursery teacher*
019	N. :	Exactly\ this way\ *adjusts the pins on the carpet the way that they are*
020		*lying parallel to the edge of the carpet and the heads of the pins are*
021		*abreast* Who wants to search for two things that belong together now/

Analysis of the sequence from interactionistic perspective

While in the 'order-relation-scene' the distribution of objects to the paper circles was taking place, in the presented sequence, objects should be elected that are belonging together. From a mathematical perspective the sorting of smaller and bigger objects

[4] see additionally Krummheuer (2007)

in the ‘order-relation-scene’ as well as in the ‘comparing-scene’ is a classification of sets. In the ‘order-relation-scene’ there is introduced a classification of the objects concerning an order relation. Objects are classified to sets of smaller and bigger objects. After this classification the ‘big’ nail is lying on the lager paper circle and the ‘small’ nail on the smaller one. The same placement process is used concerning the other objects, too. From mathematics perspective the realised classification to the sets ‘big’ and ‘small’ is only possible through the order relation of the pairs of two geometrically similar objects. These objects within the similarity-sets have different sizes by the way of a visually ascertainable metric, so they can be classified regarding the order relation in bigger and smaller ones. These pairs one by one built the sets of similar objects, which have the equivalence relation similarity. Without this underlying classification of similarity-sets for example the smaller building block can be classified to a set of big objects in comparison to the big nail, because of their sizes. This classification of similarity sets is also taken into account in the ‘comparing-scene’, which is focussed in this paper. In that case in the process of negotiation of meaning, which takes place in the ‘comparing scene’, there can reconstructed a propaedeutic potential leads to a development of the meaning of the mathematical concept “size” (e.g. Graumann 2002).

A sustainable interpretation of the ‘comparing-scene’ is that here the nursery teacher and the children negotiate the meaning of the order relations “bigger as” and “smaller as”. At the end of the sequence, after correcting the classification and allocation of the different objects concerning the paper circles a few times, the taken-as-shard meaning of the interaction is that from two objects that are looking similar regarding their shape but not their size the bigger is placed at the larger paper circle and the smaller is positioned at the smaller one. The underlying mathematical concept of this placement of the objects (to the paper circles) is firstly the order relation “bigger as” and “smaller as”, but secondary the concept of equivalence classes builds the background for the attribution of the objects. Here two objects that are mathematically similar to each other belong to one equivalence class. The concerning equivalence relation is the geometrical concept of similarity. This interaction and the positioned objects on the paper circle form the frame of references of the “new” situation. Thus the verbal expression belonging together can be interpreted as a cross reference to the classification of similarity that splits the objects in classes of at time two elements.

Thus the verbal expression “belonging together” can be interpreted as a cross reference to the classification of similarity that splits the objects in classes of at time two elements. Within the first interactional unit the girl Bettina also interprets the call for action of the nursery teacher within the meaning of a development of an equivalence class and selects two objects, which are geometrically similar – the building blocks. It should be mentioned, that this selection by Bettina is made although there are also a few other opportunities to select objects that belong together from the paper circles. Possible formal and informal equivalence relations are for example: the colour, the intended purpose, the abstract geometrical shape of the

figure and most likely the size.
In the subsequent interactional unit from line 7 to line 16 the further call for action of the nursery teacher can be understood an implementation of the starting point for a process of comparing trough the side-by-side-strategy, which also is use within the school context to simplify the "process of direct comparison" of sizes (Bart, et al., 2008). This interpretation is sustained by her hint to the line, which should be constructed trough the allocation of the two objects and is parallel to the edge of the carpet. Thereupon Bettina abolishes her election of the objects and instead of that takes up another object from the paper circles. One can assume that she does not understand the additional task the nursery teacher brings up.
The nursery teacher now points another time through her verbal expression in line 18 to the cardinal numeral of the sets of the objects, which should be collected. When Bettina takes also the second nail, the nursery points out the positioning of the objects in detail. She shows Bettina the places where she should put the nails separately by her verbal distinct verbal expressions and the accompanying gesture. In the last two interactional parts of the sequence Bettina now places the nails on the carpet and the nursery teacher gives positive evaluation on her passed challenge. After that the teacher corrects the positions of the two nails fractional until the nails build a parallel configuration with the edge of the carpet and both of the nail heads are also lying on one line parallel to the edge. This correction backs the interpretation of the nursery's implementation of a side-by-side-strategy to reduce the problem of the comparing for the kids. In the last transcribed expression in line 35 and 36 the teacher invites the other three children to take part in the situation of play and exploration and to find also objects that belong together.
After that interactional unit of the sequence there starts a multilevel interactional process, which affected by a few "corrections" of the teacher. At the end Bettina and the nursery teacher place the two objects (nails) and the nursery teacher after this ask the other children who wants to search for another pair.
The analysis of the argumentative process in the interaction will show that here the exemplification of the meaning of the mathematical concept "size" is split in a multilevel argumentation. It is particularly noticeable that within these argumentations Bettina indeed is the creator of particular argumentative steps, but she resorts only to the reference frame (the objects on the paper circles) and remains on an exemplary level of argumentation. The nursery teacher acts as an adult interlocutor and rather establishes the amplification of the argumentation through bringing up the strategy for comparing the size of the objects. She also corrects 'wrong' backings given by Bettina. The teacher thereby remains also at an exemplary level of argumentation and does not implement explicit mathematical backings to the argumentation. Through the argumentation that emerges in the interaction of Bettina and the nursery teacher the situation is structured: first the child should select two objects that are geometrically similar, then the child should place the objects side-bay-side to the carpet to simplify the process of comparing. One can assume that in this piece of interaction, which marked the beginning of a 'new' content-related

interactional unit of the situation, a format of argumentation is emerging. There is evidence that this structure of argumentation should be also used for the equivalent processes of comparing the other objects by the rest of the children. At the end of the interaction it can be interpreted that the taken-as-shared meaning of Bettina and the nursery teacher is that two similar looking objects should be placed at the carpet.
There remains doubtful if there is a taken-as-shared meaning is that a comparison of two geometrically similar objects can be simplified by the placement of the objects side-by-side.

WHAT ABOUT BETTINA? – A CONCLUSION THAT PROVIDES ANOTHER THEORETICAL PERSPECTIVE ON EARLY LEARNING PROCESSES

In the previous interpretation of the 'comparing scene' the can be interpreted that the taken-as-shared meaning that emerges within the process of argumentation is, that two things are belonging together, if they are comparable by their size when lying them side by side. The girl Bettina seems to be very productive. For her there can be reconstructed a few opportunities to participate. The leeway of participation, which is utilised by Bettina involves the status of a creator. Thereby she restricts the argumentative datum and conclusions. Concerning to process of argumentation taking place in the interaction Bettina's production of a new turn, where she picked up a new object (the nail), stands out of the process of argumentation within the scene. From interactioniastic perspective that can be seen as a creation of a new topic, but it is not interpreted as a datum, backing or conclusion in they argumentative process. That leads to the question, why Bettina creates this new turn and changes her selection. And resulting from that question: Why is the structure of the interactional process changing, respectively, which indicators can be reconstructed with regard to that change of interactional structure?

The standard model of the interactionstic perspective on the previous scene that focuses on the local or rather situational productions within the interaction did not provide a sophisticated answer to that question. The inefficiency of the interactionistic perspective concerning a sophisticating answer results from the theoretical and methodical approaches based on ethno-methodology, which removes the perspective of the socialised individual out of the interpretative focus. In contrast to the approaches of Bohnsack (2007) concerning praxeological sociology who refers to Mannheim (1964, 1980) and Bourdieu (1991), interactionistic methods do not consider the conjunctive realms of experiences[5], which are conditioned by implicit knowledge of experiences depending on socializing background. Bohnsack (2007) describes that also individual perspectives of the participants should be reconstructed

[5] See the notation of ‚konjunktiver Erfahrungsraum'(Mannheim, 1980) translated into Englisch by the term ‚conjunctive realm of experiences'.

within qualitatively reconstructive analysis to correlate situational respectively reflexively perceptible knowledge that emerges into interactional process and also tacit knowledge, which is implicitly as well as referring to the conjunctive realms of experiences and can be described as trans-situational. It should be mentioned that with regard to this approach not only individual perspectives are reconstructed outstanding of the interactional process rather it takes into account the impact of the individual perspective on the process of mutual interpretations within the process of negotiation of meaning. Thereby it can be of crucial relevance to interpret these conjunctive realms of experiences of other participants of the interaction. Especially in learning situations which are affected by asymmetrical structures of knowledge, when one of the participants can be seen as an mathematically competent interlocutor, an interpretation of the trans-situational knowledge through other members of the interaction could be difficult, because of the differences of the realms of experiences.

The socializing character of this approach also takes into account Krummheuer for early learning processes in mathematics by developing the concept of 'the interactional niche of in the development of mathematical thinking'. Krummheuer notices that there is a need for the mergence the socio-constructive approaches cultural- historical and interactionsitic theories of mathematical learning (see Krummheuer, 2011a).[6] By amalgamation of the paradigms of the two perspectives, he also mentioned the impact of languaging in reference of Bruner. But Krummheuer does not exemplify that topic in depths. For the interactionistic theory as well as the cultural-historical and the praxeocological concepts of learning linguistic markers are of crucial importance for process of negotiation of meaning, participating in the interaction or respectively discourse. As aforementioned in the description of the socio-constructivist theory, these linguistic markers are open for interpretations of other participants of the interaction, to reconstruct the theme, the opportunities to participate, the argumentation and so on. These linguistic markers thereby are underlying situational emerging meanings as well as trans-situational meanings.

One approach to grasp these linguistic markers that involve situational as well as

[6] While from cultural historical perspective child's development can be considered "as a general individual progression starting with statuses of participation that are dominated by observing and imitating actions of other participants and aiming toward statuses that are rather characterized by taking active influence on the course of interaction" (Krummheuer 2011, in press), the interactionistic concept of Brandt concerning the leeway of participation denotes that a child within these explores its cultural environment while co-constructing it. Krummheuer (2011, in press) amalgamates these to socio-constructivist paradigms: He summarizes that "the child individually utilizes the leeway of participation that is interactively accomplished and to be understood as a result of the culture the participants share. The development of thinking is then comprehensible as an individual process of cognitively active adaptation to those aspects of the process of negotiation of meaning that are conceivable to the child" (Krummheuer, 2011).

trans-situational aspects concerning the impact of socializing aspects respectively the realms of experiences of a mathematical discourse, is provided by the theory of codes by Basil Bernstein.

According to Bernstein, pedagogical situations and interactions are affected by regulative principles, so called codes. They are determined by implicit rules, which select and integrate relevant meaning, the way of realisation and the generating context (Bernstein, 1996, p. 111). Bernstein in this context speaks of the classification and the framing of the pedagogical knowledge (e.g. Bernstein, 1996, p. 5 ff.). He denominates this in such pedagogic practice as recognition and realisation rules: It controls what has to be taken as the relevant message of the communication and, how thereupon the reply has to be given. These are the two fundamental functions to each communicative situation.

In the presented context the concept of the pedagogic code and its modalities their can be reconstructed both the explicit (situational) and the implicit (trans-situational) linguistic markers and also can be analysed the performances of the children to participate within the interactional process.[7]

I will argue that Bernstein's general theory of pedagogic codes and their modalities of practice gives a second theoretical framework and tools that are fruitful for the analysis of the process of negotiation of meaning and the structures of the supportive system emerging in the interactions.

From the structuralistic perspective of Bernstein, that affords the analysis of social and linguistic aspects that are (also) trans-situational of these interactions and refer to the relevance of the thematic meanings. This way the theory enables to reconstruct also the hidden and linguistic coded rules of the mathematical learning process, which I want to examine concerning their reciprocal effects towards the thematic process of negotiation. Bernstein's theory seems to be beyond that not only recommended for research on classroom interactions, but also relevant for research in mathematical situations in the kindergarten. In addition it gives the chance to mention also the particular linguistic characteristics that may have an impact on the interaction and the negotiation of meaning in Mathematics, how Schütte (2009) showed in his research.

Though many research on socio-linguistic issues focuses on other theories (Bourdieu, 1991; Halliday & Hasan, 1976), Bernstein's approaches concerning social and linguistic issues within situations of pedagogical practice is in contrast to the others able to analyse the tacit (trans-situational) relevance of the meanings especially in the process of negotiation and generally in the learning process.

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[7] That Bernstein's theory is useful for the reconstructive process is shown by different researches in mathematics education (see Gellert, 2008; Gellert & Hümmer, 2008; Leufer & Sertl, 2010; Schütte, 2009). Regarding to that Gellert & Hümmer described how the decoding of such linguistic markers within mathematics interactions influence the opportunities to participate in the process of learning (see Gellert & Hümmer, 2008).

With regard to the previous explanations, the reconstruction of learning opportunities within the interactional process of the negotiation of meaning and the argumentation by means of the plurality of the theoretical framework (given by the different socio-constructivist approaches) permits to complete the spectrum of analysis as follows: The structuralistic perspective on the processes of learning emphasises the impact of social rules and linguistic characteristics that are coded in the specific mathematical interaction and enables to reconstruct how the participation of children in the learning process is depending not only on the understanding of the situational emerging (mathematical) issue but also of the specific social and linguistic rules concerning the subject of the mathematical interaction. Therefore it relates to trans-situational and situational emerging meanings within the discourse. That way it will enable the researchers to reconstruct a further dimension of the observation on learning opportunities and structures of supportive systems within the interactional process.
It therefore affords to observe advantages and disadvantages of children to participate in learning opportunities that emerge in the interactions as a consequence of the relationship between both of the dimensions affecting the interactional process.
Thereby the synopsis of both perspectives enables to develop a more sophisticated theoretical foundation for the understanding of early learning processes in mathematics and makes it possible to mention situational emerging meanings and trans-situational implications that have recourse to individual realms of experiences.
In further research the synopsis of the two theoretical approaches should be reconstructed empirically rich in content. Difficulties that are conditioned by the different paradigm of the approaches thereby also should be taken into account.

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