# Discourses in kindergarten and how they prepare for future decontextualised learning of mathematics

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*Abilities in using decontextualised linguistic forms seem to be of great importance for subject-specific learning in school, including the learning of mathematics. However, the basic elements for mastery of these competences are usually not taught in school, but are assumed. Where can young learners gain these abilities? Based on Cloran and Hasan's investigation of mother-child discourses, the ongoing study presented in this paper analyses preschool learning in kindergarten and compares this with mathematical learning in primary school Year 4. The goal is to investigate to what extent the linguistic discourse in kindergarten and primary school gives children the opportunity to achieve mathematics-specific discursive competences that allow them to participate successfully in the discourse of the mathematics classroom.*

**Keywords**: Academic language, kindergarten, decontextualised discourse, early mathematics learning.

## INTRODUCTION

The results of international comparison studies, such as the various PISA studies and the PIRLS (*Progress in International Reading Literacy Study), a* primary school study, show that in Germany there are significant differences in achievement levels and educational opportunities among children with different linguistic-cultural or socio-economic backgrounds (Bos et al., 2003; OECD, 2006). It is assumed that there is great potential for changing this situation if pupils can master the German language, particularly pupils with a multilingual background. According to this view, a strong connection exists between the linguistic abilities of children and their achievements in school, not only in German lessons but also in other subjects – including mathematics (Schütte, 2009). It is important to emphasise here that the current study does not focus only on children with a background of immigration or those who live and learn in several languages; rather, it concentrates on the influence of linguistic abilities on the learning of mathematics for all children.

Studies in migration research and educational science (Gogolin, 2006), as well as recent studies in mathematics education (Schütte, 2009; Schütte & Kaiser, 2011) have consequently concluded that it is not the mastering of general linguistic competences that is significant for successful (mathematical) subject learning, but competences in a subject-specific academic language. With her concept of "academic language" ("Bildungssprache") Gogolin (2006, p. 82) draws on Cummins's (2000, p. 57) concept of "Cognitive Academic Language Proficiency". Cummins makes a distinction between "academic language proficiency" and "conversational language proficiency", on the basis that children quickly gain abilities in their second language which they are able to use in everyday situations. They need significantly longer to achieve competences in the academic language of the classroom. This academic language, following Gogolin (2006), is characterised by its conceptually written form, which allows it to have high density of information and independence from situations; this means there are fundamental characteristics that do not correspond to children's everyday oral communication. However, the question is how to support children in building up sufficient (academic) linguistic competences to enable them to achieve academic success in (German) schools? Furthermore, in what ways should a school, and the teaching staff working there, seek to adapt to a pupil population entering the school system with extremely diverse abilities?

Both international and domestic research in mathematics education has recently begun to include approaches that have taken up this concept of academic language (Gellert, 2011; Schütte, 2009) and applied it to subject-specific learning, in particular to the learning of mathematics. This study aims to make a further contribution to these subject-specific modifications of the concept of academic language for the learning of mathematics. Section 2 will describe the effects of adopting an academic-language-based perspective on the learning of mathematics. The concept of academic language is discussed in the context of academic discourses, mainly on the basis of theories by Moschkovich (2002) and Krummheuer (1992). The fundamental idea is that children need to learn subject-specific discursive practices in order to be academically successful in their future school careers. The third section outlines the studies on decontextualised language use carried out by Hasan (2001) and Cloran (1994), who were able to reconstruct discursive practices of the socialisation of children in the family in early childhood. These forms of discourse used in the family also seem to be fundamental for the development of mathematical abilities. In section 4 the methodological procedure of the investigation is outlined. Section 5 shows the preliminary results.

## SIGNIFICANCE FOR THE LANGUAGE-RELATED LEARNING OF MATHEMATICS

Some studies, particularly in the international literature, have begun to improve the concept of a mathematical academic language and move beyond the deficit-oriented approach. Moschkovich (2002), for example, emphasises the discursive element of the learning of mathematics. She links her situated-sociocultural perspective on the learning of mathematics to a paradigm change away from a view of deficits as preventing learners from mastering the academic language of school to focus on the resources and competences of a diverse pupil population. According to this perspective, the learning of mathematics takes place in a social context in which the participants bring with them different ways of looking at situations, which are negotiated interactively. Approaches centred on academic language, which understand the learning of mathematics as "constructing multiple meanings of words" (Moschkovich, 2002, p. 193) and which relate to Halliday's (1975) concept of "register", often focus on the differences between children's abilities to linguistically act in or with different registers. This deficit-oriented approach leads to the idea of a 'target register' –the academic language– and a register of everyday oral communication, which is of less importance in academic discourses. With this perspective only the mastery of the academic language is seen as sufficient for success in school and the achieving of mathematical understanding. In contrast to these approaches, we suggests that the learning of mathematics always takes place in a public, social and cultural context and represents a discursive activity. There is no single correct mathematical discourse that can be achieved. Learners participate in mathematical discourses in different communities and use diverse resources in different registers in order to successfully communicate mathematically.

Interactional and non-language aspects assume a central role in this perspective on the learning of mathematics. Following this idea we can look at various studies of interactionistic approaches of interpretative classroom research in mathematics education. For example, Krummheuer (1992) shows how children are involved in collective argumentation in the learning of mathematics in primary school and that mathematical learning stems from increasingly autonomous participation in mathematics (Krummheuer & Brandt, 2001). Although, according to Moschkovich (2002), there is no single correct discourse, even while moving away from deficit-oriented approaches we must acknowledge that children will still enter school with different conditions for participation in the collective argumentation on account of their extremely differentiated socialisation in the family. Here we can refer to the studies by Cloran (1994, 1999) and Hasan (2001), who investigated the different discursive practices in familial socialisation in mother-child discourses. The central aspect of these studies is the ontogenesis of decontextualised language as a fundamental factor for successful participation in educational discourse in school.

## CHARACTERISTICS OF THE DISCOURSE OF SCHOOL EDUCATION: DECONTEXTUALISATION

Diverse authors have seen decontextualisation as an important characteristic of the pedagogical discourse (Bernstein, 1996; Cloran, 1999). However, what exactly are we to understand by this term? What is the difference between context-dependent and context-independent language? In the last 40 years much has been written about decontextualised language

use, for example relating to the difference between oral and written language and the question of language development (cf. among others Olson, 1977), the cognitive development of children (cf. among others Donaldson, 1987), and the concept of academic language and the conditions for a successful educational pathway (Cloran, 1994; Hasan, 2001). However, existing approaches offer no clear definition or description of decontextualised language. The concept is given different emphases according to the frame of reference. This can be seen for example in the use of different but basically synonymous terms such as "context-independent", "situation-independent", "autonomous" and "disembedded" (Cloran, 1999, p. 33). The present paper will engage with the sociolinguistic theories and studies of Hasan (1973, 2001) and Cloran (1994, 1999), based on the ideas of Bernstein. These authors seek to forge a link between the language that is learnt in the family in early childhood and the form of language that is prevalent in school. A fundamental definition of decontextualised language use can be found in Hasan (1973, p. 284): "The term 'context dependent' [...] may be paraphrased as follows: language that does not encapsulate explicitly all the features of the relevant immediate situation in which the verbal interaction is embedded". She emphasises the difference between "material immediate situation" and "relevant immediate situation", and notes that the correct decoding of the linguistic message is dependent on knowledge about the relevant immediate situation, although this knowledge is not linguistic in origin. In contrast, context-independent language is language that "encapsulates explicitly all the relevant features of the immediate situation in which the verbal interaction is embedded" (Hasan, 1973, p. 284).

Cloran (1994) makes use of Hasan's (1973) definition and identifies ten different types of rhetorical unit in the conversations between mothers and their preschool-age children, which she places in an order according to the level of decontextualisation. The ten degrees of decontextualised language use move from the least decontextualised, which is based in the material present moment, to the most decontextualised, based in the relations created by language itself. In order, the rhetorical units are: action, commentary, observation, reflection, report, account, plan, conjecture, recount, and generalisation (Cloran, 1999, p. 37). The rhetorical units of generalisation and conjecture play an important role in the learning of decontextualised linguistic abilities.

The idea of revealing a continuum between context-dependent and context-independent is present in Hasan (2001, p. 53). She uses the concepts "actual" and "virtual" for her investigation of mother-child discourses and the ontogenesis of decontextualised language, which refer to the context of the linguistic expression:

> A context is actual if it can be actually, that is physically sensed by the interactants. [...] A context is virtual if no possibility exists for experiencing it physically: the phenomena are, in fact, not available to the senses. (Hasan, 2001, p. 53)

From this she concludes:

> A discourse is decontextualised/disembedded, not because what it refers to is not physically present to the senses here and now, but because it refers to something that is by its very nature incapable of being present in any spatio-temporal location whatever. It is simply not sensible. (Hasan, 2001, p. 53)

Hasan (2001) also draws a distinction between constitutive and ancillary verbal actions: an action is constitutive when it recreates an actual context that is now spatio-temporally displaced. Constitutive verbal action can also bring into existence virtual contexts, which are entirely text-based. An ancillary action seeks to negotiate some physical action that is ongoing within an actual context. This leads to three different classifications for contexts of discourses: immediate (ancillary and actual), displaced (constitutive and actual), and virtual (constitutive and virtual) (Hasan, 2001, p. 54). Hasan concludes from her observations of mother-child discourses that the best learning environments for the use of decontextualised language are situations where continuity is established between actual and virtual contexts. Children thus have the opportunity to gradually move from speaking about concrete things and experiences to speaking about abstract generalisations. Hasan goes on to suggest that school is not an appropriate place for the learning of decontextualised language use because of the structures of discourse that dominate there; however, these abilities are to a great extent made a precondition for later academic success, as they become a factor for selection. Both actual and virtual contexts can certainly be observed in the classroom, but an individual child barely has any opportunity to

autonomously change between them. If we agree that the ability to use decontextualised language forms is assumed rather than taught in schools, this ability must then be learnt in pre-school places of learning, or places outside the school environment.

In her investigation of everyday mother-child discourses, Cloran (1994, 1999) discovered that frequency of use of rhetorical units with a high level of decontextualisation in the interaction was dependent on the social class of the respective family. Cloran defines this by the level of autonomy in the occupations of the child's parents. Parents who have jobs that involve a high level of autonomy, for example teacher, doctor, lawyer and so on, usually have a higher level of professional education, and their families too may have a higher level of education. Cloran found that with mothers and pre-school children belonging to this class of family, the rhetorical units generalisation and conjecture appeared significantly more frequently in the interaction than with subjects from families where the parents had a low level of autonomy in their occupation. Cloran speculates that this could be one reason for the differentiated success in school of children with different family backgrounds.

If we focus specifically on mathematics teaching, and the demands placed on children in the mathematics classroom, we can see that the ability to distance oneself from concrete contexts and to express this linguistically assumes a special importance. Particularly in the primary school environment we can conclude that the successful participation in collective argumentation is made easier for children if they have the ability to make assumptions about the contexts of mathematical discoveries, and to take that extra step to generalise these contexts. According to Donaldson (1987), this linguistic distancing from contexts represents an important aspect of the cognitive development of the individual, enabling abstract thought processes and conclusions.

Gellert (2011) also points to the special importance of linguistic decontextualisation for mathematics teaching in primary school. Mathematics in primary school is characterised by the establishing of distance from concrete everyday experiences while moving towards abstract expressions that are applicable in a general sense (i.e. generalisation). Wagner, Dicks and Kristmanson (2015) examine *children's language repertoires relating to conjecture*. It can therefore be assumed that the gaining of decontextualised linguistic discursive abilities –particularly the use of rhetorical units, which, according to Cloran and Hasan, shows a high level of decontextualisation (e.g. conjecture and generalisation) –before entering school will be helpful for mathematical learning in the classroom. With reference to Moschkovich (2002), before abilities in decontextualisation are demanded of children in the mathematical discourse of primary school, it would be helpful if they could be prepared for these demands through discourses in the family or in kindergarten. In the following we will focus on kindergarten, as educational processes are initiated in this environment by professional teachers. From these points, our research questions are:

1) What is pupils' relationship to generalisations in mathematics lessons in primary school?

2) Can we reconstruct in early discourses with pedagogical experts learning situations that promote children's abilities to change between actual and virtual contexts in the interaction?

## METHODOLOGICAL PROCEDURE AND CONTEXT

The study presented here is qualitatively oriented and can be categorised under interactionistic approaches of interpretative (classroom) research in mathematics education (Krummheuer & Brandt, 2001). The empirical basis for the study is provided by video recordings of everyday play and discovery situations, each involving a kindergarten teacher and two children (4,7–5,5 years old). The play and discovery situations can be categorised under the mathematical area of space and form, for example classic situations with building-block constructions that follow a model, or situations that principally engage spatial perception. We contrast this with video recordings of whole-class discussion during mathematics lessons in Year 4. Here the focus is on situations where the teacher introduces new mathematical concepts.

Interactions between the participating children and between the children and the attendant adults are analysed. For the investigation of discourse the transcribed video sequences are examined with the help of interactional analysis and an analysis of the used rhetorical units based on Cloran (1994) and Hasan (2001). The analyses presented by Cloran (1994) were carried

out on the basis of linguistic categories. Messages of the chosen transcribed scenarios were identified as belonging to one of the ten classes of rhetorical units: action, commentary, observation, reflection, report, account, plan, conjecture, recount, and generalisation. The study focuses here on the units Cloran highlights in relation to decontextualised language, i.e. generalisation. In examining the subject-specific negotiation of meaning within the interactions, Cloran's method of analysis is linked to the interactional analysis.

## RESULTS

In the Year 4 mathematics classroom we find multiple situations where children are asked to generalise content linguistically, shifting out of the here and now onto a more general level. The linguistic forms of the expressions the children use seem on multiple occasions not to satisfy teachers' requirements; however, teachers usually offer no explicit linguistic help. The following example illustrates this.

| | |
|---|---|
| Birkan: | I know what the "cross-sum" (German: Quersumme, "sum of digits") means. |
| Teacher: | That's oh. Prick up your ears. |
| Student: | Cross-sum is plus, you know. |
| Birkan: | Erm the cross-sum means a erm broken line. |
| Students: | No, oh I know. |
| Teacher: | That means you make everything erm total. |
| Students: | No, not total. |
| Teacher: | No, I don't know if you weren't onto something. You've, maybe you've expressed it a bit wrong. |
| Birkan: | Yes erm, if you add everything up. |
| Teacher: | That's there's. Well you're really onto something there. I think I know what you mean. So now I don't want to torture you any longer. [*The teacher writes an addition task on the board.*] |

The teacher makes clear that Birkan's answer points in the right direction but that he has incorrectly formulated it linguistically ("maybe you have expressed it a bit wrong"). After this response Birkan attempts a linguistic improvement of his answer, but this, too, seems to fall short of the teacher's expectations. Without explaining this, however, and without helping Birkan to arrive at a correct formulation, the teacher continues with the lesson and writes an addition task on the board.

The analysis of Year 4 mathematics teaching moreover puts into focus that even in primary school certain mathematical concepts, e.g. a straight line, can only be detached from the immediate context and described linguistically in a virtual context, while visual representations neglect their inherent characteristics. Switching between virtual and actual contexts seems barely possible. Here we can refer to Söbbeke (2015), who investigates the dilemma that mathematical knowledge is abstract in most cases, while using means of visualisation is indispensable for speaking with children about these abstract concepts.

In kindergarten we find above all diverse situations where the participants negotiate meanings in relation to immediate contexts and the teacher seldom generates opportunities for switching from immediate to virtual contexts within the conversation. On the one hand this seems determined by the selection of situations in the area of space and form, and on the other hand hardly surprising, given the age of the children. Only at certain points in the situations with a focus on spatial perception do we see potential for switching from an actual to a virtual discourse. However, this is mostly not on the level of mathematical discussion. One example of this can be seen in the following scenario:

| | |
|---|---|
| Jacob: | She sees the elephant. |
| Teacher: | Which elephant? |
| Jacob: | This one. [*Jacob taps on the big elephant.*] |
| Heike: | [*Heike taps first on the small, then on the big elephant.*] The big one because the small one is too small. |
| Teacher: | Why doesn't she see it? |
| Jacob: | Because it's too small. Because it's a baby elephant. |
| Teacher: | But you can see baby elephants, too. Why doesn't she see it now? |
| Jacob: | Because there's a wall here. |

At this point the adult confirms Jacob's answer and asks a new question, whose content has no connection to his argument. However, from our point of view this situation shows potential. After Jacob's utterance about the wall, the accompanying adult could lead the discussion in a direction where the children are asked to think about the fact that other small animals, plants

or objects could not be seen behind the wall either, and, ultimately, that nothing behind a wall that is shorter than the wall can be seen. This could be a first step towards the use of generalisation and switching from an actual to a virtual context.

## SUMMARY AND FUTURE PERSPECTIVES

Our results let us assume that conversational situations that contain various individual possibilities for switching between immediate and virtual contexts appear only rarely, and that children are expected to be able to use decontextualised language without receiving help. In addition we might assume that discourses in kindergarten similarly offer only limited points of access for learning such linguistic competences, and that at least play situations in the area of space and form offer limited potential for introduction to decontextualised language use. This could be because this area is introduced above all through immediate, enactive, and visual means, especially in early learning processes. It may therefore be unnecessary for participants to switch into virtual contexts, because the mathematical area provides very good points of access to immediate contexts. Through looking at other context areas that might evoke a greater need for the use of decontextualized language nuance could be added to this hypothesis and the theoretical construct of the typification of contact with decontextualised language in early education could be extended to different kinds of mathematical content. Furthermore, the question needs to be addressed of whether examples can be found of initiation of switching between contextualised and decontextualised forms of language, and of help offered to children to master decontextualised forms of language, at any earlier point in primary education.

## REFERENCES


Bernstein, B. (1996). *Pedagogy, symbolic control and identity.* London: Taylor & Francis.

Bos, W., Lankes, E.-M., Prenzel, M., Schwippert, K., Walther, G., & Valtin, R. (Eds.) (2003). *Erste Ergebnisse aus IGLU. Schülerleistungen am Ende der vierten Jahrgangsstufe im internationalen Vergleich.* [First results from IGLU. Pupil achievement at the end of Year 4 in international comparison] Münster, Germany: Waxmann.

Cloran, C. (1994). *Rhetorical units and decontextualisation: an enquiry into some relations of context, meaning and grammar.* Monograph 6 in Systemic Linguistics. Nottingham: University of Nottingham.

Cloran, C. (1999). Contexts for learning. In F. Christie (Ed.), *Pedagogy and the shaping of consciousness: linguistic and social processes* (pp. 31–65). London: Casell.

Cummins, J. (2000). *Language, power and pedagogy: bilingual children in the crossfire.* Clevedon, UK: Multilingual Matters.

Donaldson, M. (1987). The origins of inference. In J. Bruner & H. Haste (Eds.), *Making sense. The child's construction of the world* (pp. 97–107). London: Methuen.

Gellert, U. (2011). Mediale Mündlichkeit und Dekontextualisierung. In S. Prediger & E. Özdil (Eds.), *Mathematiklernen unter Bedingungen der Mehrsprachigkeit – Stand und Perspektiven der Forschung und Entwicklung in Deutschland* [The learning of mathematics under multilingual conditions – current situation and future perspectives for research and development in Germany] (pp. 97–116). Münster, Germany: Waxmann.

Gogolin, I. (2006). Bilingualität und die Bildungssprache der Schule. In P. Mecheril & T. Quehl (Eds.), *Die Macht der Sprachen. Englische Perspektiven auf die mehrsprachige Schule* [The power of languages. English-speaking perspectives on the multilingual school] (pp. 79–85). Münster, Germany: Waxmann.

Halliday, M. A. K. (1975). Some aspects of sociolinguistics. In UNESCO (Ed.), *Interactions between linguistics and mathematical education* (pp. 64–73). Copenhagen: UNESCO.

Hasan, R. (1973). Code, register and social dialect. In Bernstein, B. (Ed.), *Class, code and control* (Vol. 2, pp. 253–292). London: Routledge & Kegan Paul.

Hasan, R. (2001). The ontogenesis of decontextualised language: some achievements of classification and framing. In A. Morais, I. Neves, B. Davies, & H. Daniels (Eds.), *Towards a sociology of pedagogy: the contribution of Basil Bernstein to research* (pp. 47–79). New York: Peter Lang.

Krummheuer, G. (1992). *Lernen mit „Format". Elemente einer interaktionistischen Lerntheorie. Diskutiert an Beispielen mathematischen Unterrichts.* [Learning with 'format'. Elements of an interactional theory of learning. Discussed with examples from the teaching of mathematics] Weinheim, Germany: Deutscher Studien Verlag.

Krummheuer, G., & Brandt, B. (2001). *Paraphrase und Traduktion. Partizipationstheoretische Elemente einer Interaktionstheorie des Mathematiklernens in der Grundschule.* [Paraphrase and traduction. Participation-theoretical elements of an interactional theory of the learning of mathematics in primary school] Weinheim, Germany: Beltz Verlag.

Moschkovich, J. (2002). A situated and socialcultural perspective on bilingual mathematics learners. *Mathematical Thinking and Learning*, *4*(2–3), 189–212.

OECD (2006). *Where immigrant students succeed: a comparative review of performance and engagement in PISA 2003.* Paris: Author.

Olson, D. (1977). From utterance to text: the bias of speech and writing. *Harward Educational Review*, *47*(4), 257–281.

Schütte, M. (2009). *Sprache und Interaktion im Mathematikunterricht der Grundschule. Zur Problematik einer Impliziten Pädagogik für schulisches Lernen im Kontext sprachlich-kultureller Pluralität.* [Language and interaction in mathematics in primary school. On the problem of an Implicit Pedagogy for school learning in the context of linguistic-cultural plurality] Münster, Germany: Waxmann.

Schütte, M., & Kaiser, G. (2011). Equity and the quality of the language used in mathematics education. In B. Atweh, M. Graven, W. Secada, & P. Valero (Eds.), *Mapping equity and quality in mathematics education* (pp. 237–251). New York: Springer.

Söbbeke, E. (2015). Language use in process of interpretation of mathematical visualizations. In K. Krainer & N. Vondrová (Eds.), *Proceedings of CERME9* (this volume).

Wagner, D., Dicks, J., & Kristmanson, P. (2015). Students' language repertoires for prediction. In K. Krainer & N. Vondrová (Eds.), *Proceedings of CERME9* (this volume).