English Abstracts

Part 1: Analysing challenges for multilingual learners – theoretical approaches and empirical results

Aiso Heinze, Leonie Herwartz-Emden, Cornelia Braun, Kristina Reiss: The role of knowledge in the language of instruction for mathematics learning Results of a longitudinal study in primary schools

In the last decade, several empirical studies repeatedly showed that students with migration background achieve lower competencies in the German educational system than students without migration background. This affects not only the domains reading and writing but also domains like mathematics which might be less influenced by language and culture. Research findings show that one of the main reasons for the disadvantages of students with migration background goes back to their restrictions in their capabilities of the language of instruction. In this paper, we give an overview on different aspects of research in this field. We present results from large scale studies with respect to the German situation. Moreover, research studies from mathematics education are discussed which in particular investigate the influence of language capabilities on learning of mathematics in school.

Joana Duarte, Ingrid Gogolin, Gabriele Kaiser: Language-related difficulties of multilingual students in word problems

It has been extensively proven that students with a migration background perform significantly worse in the German education system than their monolingual peers. As a central reason for this educational backlash, linguistic difficulties are often identified, although few studies have acknowledged concrete linguistic phenomena. The paper deals with the role of academic language skills for the understanding of mathematical word problems by pupils with a migration background. First the concept of the academic language is closely explained and some empirical findings are presented. Thereafter, theoretical models of textual understanding of mathematical word problems are analysed and exemplified on the basis of own empirical studies. The conclusions then contain a short summary of the consequences of the central theoretical and empirical findings for the didactics of mathematics.

Heidi Rösch & Jennifer Paetsch: Word problems and authentic problems in mathematics classrooms as a challenge for multilingual children

Linguistic heterogeneity, containing various forms of multilingualism, has become an everyday situation in German schools. First, we describe the special problems immigrant students are experiencing with the language used in class. Subsequently, the role of language in math class is being highlighted and concretized regarding multilingualism. By means of empirical findings, the article will demonstrate that learning achievements in maths will be compromised by insufficient linguistic skills of immigrant students. The major focus is on the challenge of math word problems which is caused by the context-reduced and abstract language use. This will be at first reported

on the state of research and then exemplified by concrete instances. In conclusion, the article outlines a rough orientation guide for math classrooms.

Wilhelm Grießhaber: On the Role of Language in Second-Language Maths Classes

Pupils whose L1 is not German have been found to do less well in German maths classes. Three learner groups have been distinguished in an attempt to find an explanation for this phenomenon, namely learners in their first year of primary school, learners who have joined the German school system later, and pupils with an ethnic German background who are already attending school in Germany. In order to clarify the role of language for the acquisition of mathematical knowledge, objects and the mathematical operations applied to them are studied separately. In this context, language serves to determine the relevant characteristics of an object and of the suitable mathematical operations. Profile analysis as a means to assess L2 competence is introduced and demonstrated with regard to selected texts and learner utterances. In Primary One lessons, insufficient knowledge of German makes teaching methods that work with German-speaking pupils less effective. Results of initial profile analysis indicate that the children's difficulties in solving text-based maths problems are not so much due to lexical problems but in their failing to connect difficult words with the underlying grammatical structure of the text. In the example given, the mathematical knowledge also seems insufficiently developed. It seems, therefore, that more attention should be paid to teaching formal grammar aspects to provide a basis for understanding written information.

Uwe Gellert: Medial Orality and Decontextualisation: Significance and Special Nature of Academic Language Proficiency in Primary Mathematics Education

The specific nature of students' successful language use in primary mathematics classrooms is a rather unexplored issue in mathematics education. This chapter draws on concepts from disciplines such as the sociology of education, studies in bilingualism, and systemic functional linguistics that seem pertinent for studying the appropriateness of students' language production as well as for the development of their competence. By referring to examples of students' language production in the context of mathematics, the relevance and explanatory power of these references are illustrated.

Erkan Özdil: Linguistic analysis of diagnostic interviews in mathematics education research

In the article, an example for students‘ work on word problems is analysed by an linguistic approach for investigating text-based processes of problem solving. The analysis shows problems of understanding that do not root in linguistic deficits of the learners but in obstacles in the text.

Part 2: Supporting multilingual learners in mathematics classrooms: Development and research

Josef Leisen: Language-sensitive domain-specific classrooms. An approach for developing language in mathematics and science education

Developing language capabilities is important in all domains since language develops together with new knowledge in a domain like mathematics or science. As a consequence, language and domain-specific subject matters should be taught and learned together. The approach of language sensitive domain-specific classrooms focuses on

language as a medium for learning and teaching. The article offers basic knowledge about language development and about teaching strategies for supporting it.

Susanne Prediger & Lena Wessel: Representing – Interpreting – Relating registers. A mathematical and linguistic support for multilingual learners in mathematics education

Difficulties of students whose first language is not the language of instruction are mostly considered separately, either as a mathematical or as a linguistic problem. This separation is often reflected in isolated teaching approaches for these students. Meanwhile, there is a lack of theoretically funded and empirically investigated approaches that consequently integrate linguistic and mathematical aspects for supporting students' conceptual understanding. We present our integrated approach „relating registers" in a case study for fractions. The design experiments show the situational potential for enhancing students' conceptual understanding.

Michael Meyer & Susanne Prediger: Making use of the first language for mathematics learning. Case studies on chances and limits of working in two languages for learners with Turkish as first language

Although the benefit of the first language for affiliating processes of thinking and understanding in mathematics education has been shown in many countries, this teaching strategy has not yet been focused much in Germany, neither in classroom practices nor in educational research. The article presents explorative approaches and tentative results on interview studies with students of Turkish origin who deal with realistic mathematical texts. In the qualitative analysis, we investigate conditions of first language use in research settings and the initiated chances and limits of using the first language to develop conceptual understanding in mathematics.

Jochen Rehbein: The role of Turkish as 'working language' in German primary school maths and science classes

The paper scrutinizes the role of the immigrant language Turkish as a medium of learning in German primary education focussing on mathematics and natural science. After the discussion of theoretical approaches, an Evocative Field-Experiment is documented. In this experiment, Turkish children in the 4th class of a Hamburg primary school were videotaped during group work without the presence of a teacher. Whereas the task was given in German and the results had to be written down in German, as well, they had the option to use German or Turkish while working together ('working language'). Although the children had been at a German school for four years, they did not use mainly German, as expected, but mainly Turkish in their problem-solving interaction. This interaction is analyzed on the basis of some transcript extracts, and it is pointed out that the concepts of 'Arbeitssprache' (working language) and 'Denksprache' (language of thinking) cannot be mapped either to Turkish or to German (this is consistent with our earlier observations; s. Grießhaber / Özel / Rehbein 1996). It turns out that Turkish as a working language facilitates a certain type of discourse, in the framework of which the children can practice actions in a communicative space of rehearsal. The findings strongly suggest that immigrant children should be given the chance to use their family languages as 'working languages' by offering them a communicative space of rehearsal within usual primary education.