

Title: Construction of elementary pupils' geometric schemas via motivating learning environments

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Abstract: The aim of the dissertation is to discuss teaching geometry as integral part of mathematics education at the primary school level. The thesis also documents a longitudinal teaching study which was initiated in 2010 and which gives us a base for discussion of some fundamental questions regarding the process of learning geometry for pupils in their early school years. The main objective here is to attempt to answer the following four didactic questions: In which way do pupils learn about geometrical objects? How do they share their geometrical knowledge, experience and discoveries with one another? How much (at what level) are they able to understand mathematical concepts that the official curricular documents (the Czech Framework for Education Program) place in later years of schooling? What phenomena are they able to grasp and describe using their mother tongue?

The theoretical framework focuses on the learning process and the typology of mathematical problems in geometry. Four specific engaging environments (Cube Buildings, Origami, Wooden Sticks, and Tiles) and one content area (Area and perimeter in plane) are introduced, described and didactically analysed. There is also a proposed extension of these environments into further years of mathematics education: the formulation and solution of problems that are grounded in these environments and build on the relevant concepts in higher levels of mathematics.

Four case studies form the foundation of the empirical investigation. Each of the case studies describes and analyses one classroom situation. The situations were carefully chosen to prepare and conduct a teaching study. The first case study looks at the combinatory analysis of a cube construction and the analysis of a pupil's combinatorial thinking. The second case study is about the ways pupils learn about the characteristics of polygons. The third case study focuses on the relationship between the plane and space geometries. The last case study is an investigation into a pupil's understanding of the concept of isometric and non-isometric transformations in the plane.

The conclusion highlights the main contribution the dissertation brings, discusses the limitations of applied research in this area, and outlines the rationale for further research.