Summary

In the past decade, more and more geography teachers, teacher trainers, and scientists in the field of secondary education have become interested in the possibilities of using Geographic Information Systems (GIS) in inquiry-based geography education. Although many authors rave about GIS, little is known about the characteristics of optimal approaches to GIS-supported inquiry-based geography education. In order to stimulate the diffusion of GIS in secondary geography education, we need to have both a good theoretical framework for GIS-supported inquiry-based geography education, and more empirically-based knowledge about how GIS-supported inquiry-based geography education can be realized in practice.

The theoretical part of the dissertation presents a model for GIS-supported geographic inquiry, and tries to answer questions such as: “What is the nature of knowledge about the world around us?”; and “What is the nature of geographic thinking?” These insights may help teachers to reorganize their geographic knowledge and geographic thinking processes. They may also help teachers to design tasks that aim to raise students’ geographic knowledge and geographic thinking processes to a higher level. In addition, they may help teachers to diagnose problems in students’ geographic thinking, and help teachers to support students so that they are able to overcome these problems.

The practical part of the dissertation explores how GIS-supported inquiry-based education can be realised in practice. This is done by discussing the outcomes of the design process of a GIS-supported geographic inquiry project. The project was developed together with nine teachers from six schools via five progressive cycles of designing, testing, and evaluating. In total, 375 students from HAVO (senior general education) and VWO (pre-university education) participated in the tests. Students were between 15 and 17 years old. The GIS-supported geographic inquiry project covers the full cycle of the geographic inquiry process: students formulate inquiry questions; collect geodata via fieldwork; construct GIS maps on the basis of the geodata; and use these maps to answer their inquiry questions.

The main conclusion of the design process is that there are many conditions for the optimal use of GIS. During the design process, it became clear that GIS-supported geographic inquiry projects should aim to stimulate deep learning on the geographic content and on geographic inquiry strategies. In order to be legitimate, the projects should be based on a consistent and practical domain-specific construct for use in educational settings. In order to be viable, the projects should offer considerable amount of guidance. Teachers need to work very systematically and provide a lot of structure. As the success of every phase depends on the success of the previous phase, geographic inquiry projects with GIS are more prone to getting stuck than geographic inquiry projects without GIS. The requirements are to be strictly adhered to in order to secure the viability of the project. Finally, in order to be effective, the projects should include several preparatory and evaluative tasks. In addition, teachers should organise preparatory and evaluative whole-class discussions, and offer one-on-one support when students are working on their project. The practical part of this dissertation provides design principles for appropriate learning goals, design principles for consistent and practical domain-specific constructs for use in educational settings, and design principles for viable and effective tasks and coaching strategies.

It has been known for long that thinking in a systematic way about the world around us helps to better understand the world around us. This seems to be especially the case when studying the
world around us with GIS, as working with GIS requires people to make their geographic thinking explicit and external. They have to choose the right GIS operations and have to apply these GIS operations on the right geodata; otherwise they will not be able to answer their questions. This dissertation therefore underlines the importance of teaching students to think in a systematic way when they work on GIS-supported geographic inquiry projects. This implies that the role of a teacher as a ‘coach in systematic geographic thinking’ is indispensible. However, in the course of the design process, it became clear that stimulating deep and systematic geographic learning via GIS-supported inquiry-based geography education is complex and difficult for teachers, as they need to have knowledge in the fields of technology, pedagogy, and geographic content, and knowledge on the interplay of these fields. The importance of the content knowledge (CK) and pedagogical content knowledge (PCK) of teachers is more and more underlined in the literature and in educational policy. This dissertation shows that it is of particular importance that teachers are able to reorganize their knowledge about geographic subjects and that they are able to translate this knowledge to geographic theories for use in educational settings. Only then will they be able to effectively diagnose deficiencies in students’ geographic knowledge and geographic thinking, and will they be able to formulate effective interventions so that students are able to overcome these problems. This is one of the largest challenges for teachers to provide optimal coaching when their students work on GIS-supported geographic inquiry projects. The practical part of the dissertation provides insight into the nature of this challenge and gives some ideas about what can be done to overcome this challenge and raise the effectiveness of secondary geography education.