What children and youths learn in school forms the basis for their approach to society and to science. They gain first experiences in scientific thinking, in asking questions, in planning experiments and evaluating the results. To foster the role of spatial information in society and to support the development of spatial skills it is important to point learners early on to the transdisciplinary power of spatial information and spatial thinking. Equipped with such knowledge and competences, they enter college with a broader view of the role of space and time and can identify spatial information concepts in various disciplines, now that they can easily get access to a lot of spatially and temporally referenced data.

Spatial thinking and learning can be applied to basic notions of space, where a variety of categorizations are available. One can distinguish between figural, vista, environmental, and geographical spaces (Montello, 1993) and apply a plethora of spatial concepts to these (i.e., the selection presented at teachspatial.org/concept-browser). Several spatial concepts, i.e., referring to position, are being learned in (early) childhood: i.e., learning of distance, direction and orientation as part of the natural human development, as works of developmental psychologists show (Piaget, Tversky, Lyben, Newcombe).

Several activities at the Institute for Geoinformatics, especially in the GI@School Lab address these goals. In the Geospatial Learning project, we develop software to support spatial thinking by following the known principles to foster orientation, way finding and map understanding skills. We combine them with user-centered design, game-based learning and situated computing and evaluate with different usability and spatial competence tests. We also develop projects for and with high schools, where students work with these and other geospatial technologies (i.e., GIS, GPS, Virtual Globes…) in a transdisciplinary context. A recent weeklong project with 80 high school students was, for example, about spatial information in history and archeology.

In these projects we realized that the more specialized concepts of spatial information (as opposed to just spatial concepts) are often too complex for high school students. A core selection of these concepts (Kuhn, 2012) enumerates Location, Neighborhood, Field, Object, Network, Event, Granularity, Accuracy, Meaning, and Value. High school students have bigger difficulties in understanding the technical notions of meaning, accuracy or event, sometimes just because of their lack in the mathematical background (logic, probability theory, abstract algebra). The learning and understanding of these concepts is therefore may therefore complement that of “classical” spatial concepts, but at a later stage in college.

Position: Spatialization before Specialization
Learning of concepts of spatial information across disciplines requires experience with spatial concepts and a solid mathematical understanding, so that it best fits the final phase of undergraduate studies, preceding or accompanying a specialization in domain concepts. To fulfill this educational position, we propose an advanced transdisciplinary undergraduate course on core concepts of spatial information. The contents will be aimed at undergraduate students with enough mathematical background and some associated knowledge and skills (i.e., in computing or cognitive sciences), preparing their further specialization in graduate studies.

The one-semester-long course (approximately 15 sessions) is planned as a cross-campus offer in the Spatial@WWU initiative (http://spatial.uni-muenster.de), where many institutions from our university have participated in a lecture series on spatial concepts in their disciplines in 2010 and 2011. It will introduce spatial thinking in the first sessions, taking into account the role of spatial information in each of the participating disciplines. The ten core concepts proposed by Kuhn (2012) will be the topics of the further sessions one by one, where the students will learn about similar and different forms these concepts take between disciplines. This learning will take place in discussions after prepared readings of associated literature. The rest of the time students will develop demonstrators or examples for application of the discussed concepts in different disciplines. The course format follows that of a similar course that has been taught to geoscientists and geoinformatics students over the past few years.

A collaboratively developed product will be a platform, similar to the concept-browser of teachspatial.org, where the core concepts of spatial information are explained with several examples from different sciences and points of view. The examples will be provided as linked data in RDF to allow a linkage and further use and connections from other platforms and disciplines. As such, the course will foster inter- and trans-disciplinary work and a view on domains from another, spatial and temporal perspective. We expect positive effects on motivation due to the cross-disciplinary cooperation involving actual domain problem solving.