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# Strategies for teaching cartography from theory and practice

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## Abstract:

If Robinson (1952, 4) suggested that the essential task of the cartographer was “to make the data intelligible for the reader,” perhaps the essential problem for those of us that teach cartography is to make information *learnable* for students. As a design problem, teaching has three main components: we *present* instructional materials to students, we *create environments* for students to engage with what we present, and we provide *feedback* that aims to measure and motivate learning. This paper aims to help cartography educators design effective instruction in two ways: (1) by defining principles and patterns for effective instructional design that are gleaned from empirical studies of cognitive theories of learning and from pedagogical patterns of reflective practice; (2) by illustrating how these principles and patterns can inform cartography education with specific examples from an undergraduate course on cartographic design.

Cognitive theories of learning can inform instructional design based on the premise that “designs that are consistent with the way the human mind works are more effective in fostering learning than those that are not” (Mayer 2009, 13). They provide three key insights (Mayer 2005). First, working memory has a limited capacity to process information at one time. Second, we have two separate channels for processing visual and auditory information (both with limited capacities). Third, we don’t acquire knowledge passively but rather we actively engage in learning. This active engagement involves three key tasks: (1) figuring out or selecting the key information that we should pay attention to, (2) organizing this information into models, and (3) relating these models with previous knowledge. Within this theoretical framework, empirical studies have identified principles for instructional design that deal largely with presentation methods. In addition, they offer some helpful prescriptions for designing task environments that support learning by solving problems, for assessing learning, and for promoting learning through reflection.

Pedagogical patterns aim “to offer a format and a process for sharing successful practices in a way that allows each practice to be used by a variety of people in many different ways” (Bergin 2012, iii). A pedagogical pattern is a template for instructional design that identifies a recurring problem and offers a general strategy for solving the problem. They do not originate from controlled experiments of theory, but rather they are discovered through the practice of teaching and by reflecting on these experiences. As such, they are similar to advice a junior colleague might receive from a senior mentor. They complement cognitive-based principles because they deal with aspects of teaching that are often missing from the controlled laboratory environments of empirical research. This includes strategies for designing social learning environments and active learning environments, and for providing constructive feedback.

From these two sources, I compile a list of strategies organized by each design component. For designing presentations, strategies deal with questions of *substance* (what should you include in a presentation?), *arrangement* (how should you arrange or sequence elements of a presentation?), and *modality* (what should be the mode or form of a presentation?). For designing environments, strategies deal with questions of *social environments* (how should students interact with each other and with the instructor?) and *task environments* (how should students engage in activities or problems?). For feedback design, strategies deal with questions of *assessment* (how should you measure meaningful learning?), *motivation* (how should you deliver feedback to motivate learning?), and *reflection* (how should students reflect on their learning outcomes?).

Because empirical principles and pedagogical patterns were developed for instruction in other domains, this article illustrates them with specific examples of instructional materials that I have developed for teaching cartographic design to undergraduate students. Examples include lecture activities, software tutorials, task scaffolding, and feedback methods.

The main contribution of this article is to illustrate a framework that makes two important connections. First, it bridges principles from theory with patterns from practice. Second it links general principles/patterns with specific examples of their implementations. For experienced teachers, the principles, patterns, and examples described here may appear obvious or old hat, but for educators with little previous experience teaching, they may be especially helpful. In the future, it would be helpful if experienced educators contributed towards a resource for principles, patterns, and examples in cartography that young educators could draw from as they learn how to teach cartography.

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