



# Pattern-oriented instruction, its practical application, and the connection to various manifestations of abstraction in computer science

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by

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## Abstract

Abstraction is a fundamental idea in computer science (CS). It is a cognitive means for thinking about an idea, a concept, a situation, or any object of thought at different levels of details, from high levels of abstraction by ignoring details and focusing on the "big picture", to low levels of abstraction by going into the details of the object of thought.

Pattern-oriented instruction (POI) is an instructional CS approach that relies on algorithmic patterns (APs). APs are abstractions of solutions to common algorithmic problems, for example, finding the maximal value in a given sequence of values. In POI, APs are used as an organizing factor of learning, as well as a problem-solving strategy. Teaching through POI has been shown to help students acknowledge APs and incorporate them into their solutions, as well as increase their abstraction skills, analogical reasoning, and problem decomposition skills.

In this work, I investigated the connection between POI and abstraction in a wide context. In particular, I examined the connections between three main factors: the teaching approaches of teachers in the context of POI, the teaching approaches of teachers in the context of employing and emphasizing abstraction, and the students' abstraction abilities.

The outcomes show that 1) the connection between the extent teachers employ POI and their students' abstraction performance are limited at best; 2) there is a gap between the way teachers perceive their teaching with respect to abstraction, and the way they actually emphasize abstraction in class; 3) students of teachers who perceived themselves as promoting abstraction, exhibited better abstraction skills in relation to several abstraction indicators; 4) students of teachers whose actual teaching approach was geared towards

promoting abstraction, exhibited lower performance in relation to several abstraction indicators; 5) teachers who used POI, whether in a full or partial manner, tended to perceive their teaching as emphasizing abstraction in a full or partial manner, respectively; and 6) teachers who did not use POI, varied regarding the extent to which they perceived their teaching as emphasizing abstraction.