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(An Almost) Pedagogical Pattern for Pattern-Based Problem-Solving Instruction

The paper introduces a pattern-based problem-solving instruction approach for teaching an introductory computer science (CS) course. The approach aims at supporting a shift from a programming-based instruction, which emphasizes programming language syntax, to a problem-solving oriented instruction which emphasizes the development of algorithmic problem-solving skills, as well as program-design skills. Such a shift is not easy for teachers to adopt; hence, a significant conceptual and pedagogical change in instruction should be employed. We believe that the pattern-based problem-solving instructional approach is suitable for triggering this change.

Our paper describes an effort to train a group of in-service CS teachers during an annual, long-term “Patterns and Pedagogy” workshop, in which teachers were exposed to both algorithmic patterns and pedagogical patterns, and their incorporation into class instruction plans was discussed.

Patterns of different kinds have been defined by the computer science community. The introduction of patterns in a pedagogical context follows psychological studies suggesting that programming expertise is represented by personal knowledge of pattern-like chunks, which consist of problems, their solutions and associated information. Given a problem, the expert in any area can retrieve an appropriate solution schema from his memory. In addition, patterns tend to externalize and transfer expertise knowledge, and therefore serve as means for peer-communication.

Algorithmic patterns, which are solutions to basic recurring algorithmic problems, form the building blocks for the development of algorithms. The pattern-oriented instruction is directed towards supporting the construction of students' knowledge and the development of their problem-solving proficiency.

In order to assimilate patterns, we introduce general guidelines for choosing and sequencing a set of problems, which deal with various aspects of using a certain pattern. The guidelines for constructing problem-solving class activities raise teachers’ consciousness of covering many ideas related to a pattern, which otherwise may be ignored, or mentioned without underlining their importance.

The paper describes a teachers’ workshop and the analysis of teachers’ final products during the course. Our study indicates that the teachers indeed utilized pedagogical patterns to plan classroom activities relevant to their concrete needs.

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