

Adapting Between Parsons Problems and Coding Tasks

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ABSTRACT

Previous research has shown that Parsons problems are an effective scaffolding activity for coding. Recently the development of Adaptive Parsons problems has provided more flexible scaffolding for students learning to code. However, there is still a gap between Parsons problems and coding tasks which can both challenge and frustrate novices. As such, we have developed an adaptive learning tool which looks to bridge this gap and support transitioning directly between Parsons problems and code writing.

KEYWORDS

Adaptive Learning, Computer Science Education, Parsons problems, Coding

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1 INTRODUCTION

Parsons problems is a scaffolding technique for students which involves rearranging blocks of code to form a correct solution [6]. Prior research has shown it to be effective by allowing students to focus on learning how code works without the frustration of encountering syntactic errors [3].

Variations of Parsons problems have emerged that introduce new learning challenges as well as improve code comprehension. For example, adding in incorrect blocks called distractors [2] or in Faded Parsons problems requiring blank variable names and values to be filled in by the learner [7]. Another variation that provides more flexibility is adaptive Parsons Problems [3]. Adaptive Parsons allow the learner to adjust aspects of the problem such as the size of code blocks being arranged and the number of distractors used.

While Parsons problems are a scaffolding technique for learning coding, they are often viewed as a separate learning activity from coding. The gap between Parsons Problems and coding tasks leads to several questions including: (1) How should students transition from a Parsons problem to a coding task? (2) If a student struggles with a coding task is there value in transitioning back to a Parsons problem?

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Our tool extends adaptive Parsons problems to include adapting directly between a challenging Parsons problem task and a coding task. We next plan to assess the learning benefits of our tool through a user study. We are also interested in assessing whether the ability to adapt directly from a Parsons problem to a coding task and back reduces the learner frustration reported in earlier studies [4, 5].

2 APPROACH

Our new adaptive Parsons problems tool includes the adaptation strategies developed in previous work [3] and extending it to include the ability to adapt directly to and from a coding task. This allows students to work at a self-selected level of difficulty from a Parsons problem with no distractors all the way up to writing code. Specifically, students can move between five levels:

- (1) two-line blocks of code with no distractors
- (2) two-line blocks of code with a low number (e.g., 1-2) of distractors
- (3) one-line blocks of code with a low number of distractors
- (4) one-line blocks of code with a moderate number (e.g., 3-4) of distractors
- (5) writing code in an online editor

We adapt from a Parsons problem to a code task by moving any solution code in the Parsons problem to the editor. Adapting from code back to a Parsons problem is considerably more challenging due to the free-form nature of coding where a learner may use different variable names and coding choices than those included in the solution code as well as make different errors than those included as distractors. To support this transition we use clone detection [1] to map learner written code to the Parsons problem solution code. We also incorporate learner generated mistakes as distractors and utilize learner created variable names in the Parsons problem task to enhance comprehension.

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