Designing an Adaptive Web-Based Learning System Based on Students' Cognitive Styles Identified Online

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Abstract

This study developed an adaptive web-based learning system focusing on students' cognitive styles. The system is composed of a student model and an adaptation model. It collected students' browsing behaviors to update the student model for unobtrusively identifying student cognitive styles through a multi-layer feed-forward neural network (MLFF). The MLFF was adopted because of its ability on imprecise or incompletely understood data, ability to generalize and learn from specific examples, ability to be quickly updated with extra parameters, and speed in execution making them ideal for real time applications. The system then adaptively recommended learning content presented with a variety of content and interactive components through the adaptation model based on the student cognitive style identified in the student model. The adaptive web interfaces were designed by investigating the relationships between students' cognitive styles and browsing patterns of content and interactive components. Training of the MLFF and an experiment were conducted to examine the accuracy of identifying students' cognitive styles during browsing with the proposed MLFF and the impact of the proposed adaptive web-based system on students' engagement in learning. The training results of the MLFF showed that the proposed system could identify students' cognitive styles with high accuracy and the temporal effects should be considered while identifying students' cognitive styles during browsing. Two factors, the acknowledgment of students' cognitive styles while browsing and the existence of adaptive web interfaces, were used to assign three classes of college freshmen into three groups. The experimental results revealed that the proposed system could have significant impacts on temporal effects on students' engagement in learning, not only for students with cognitive styles known before

browsing, but also for students with cognitive styles identified during browsing. The results provide evidence of the effectiveness of the adaptive web-based learning system with students' cognitive styles dynamically identified during browsing, thus validating the research purposes of this study.