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Cognitive Trait Model for Adaptive Learning Environments

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"If we understand the human mind, we begin to understand what we can do with educational technology."

- *Herbert A. Simon*

Abstract

Among student modelling researches, domain-independent student models have usually been a rarity. They are valued because of reusability and economy. The demand on domain-independent student models is further increased by the need to stay competitive in the so-called knowledge economy nowadays and the widespread practice of lifelong learning. On the other hand, the popularity of student-oriented pedagogy triggers the need to provide cognitive support in virtual learning environments which in turn requires student models that create cognitive profiles of students. This study offers an innovative student modelling approach called cognitive trait model (CTM) to address both the needs mentioned above.

CTM is a domain-independent and persistent student model that goes beyond traditional concept of student model. It is capable of taking the role of a learning companion who knows about the cognitive traits of the student and can supply this information when the student first starts using a new learning system. The behaviour of the students in the learning systems can then be used to update CTM.

Three cognitive traits are included in the CTM in this study, they are working memory capacity, inductive reasoning ability and divergent associative learning. For the three cognitive traits, their domain-independence and persistence are studied and defined, their characteristics are examined, and behaviour patterns that can be used to indicate them are extracted.

In this study, a learning system is developed to gather behaviour data of students. Several web-based psychometric tools are also developed to gather the psychometric data about the three cognitive traits of students. In the evaluations, Cognitive trait modelling is then applied on the behaviour data and the results are compared with the psychometric data. The findings prove the effectiveness of CTM and reveal important insights about the three cognitive traits.

Keywords: Cognitive trait model, working memory capacity, inductive reasoning ability, divergent associative learning, psychometric tools, student model, adaptive learning systems

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