

Title	オンライン学習環境における自己調整学習能力認知フレームワークとMarkovモデル
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Abstract

We are motivated to discover and to know. And one thing that we always do consciously or unconsciously is to learn. Discovering knowledge is motivating. But it is even more desirable to know ourselves, our way of learning, and our learning habits with their strengths and weaknesses so that we can learn effectively, efficiently, patiently, and fruitfully. The modern world today enables us to approach knowledge so quickly that we might rarely think of any roadblock to the learning process. However, the last two years tells us otherwise. COVID-19 pandemic has prevented millions of learners worldwide from knowledge acquisition. Many learners have suffered anxiety and depression from disconnection from knowledge. In this challenging situation, we have realized a fortunate. It is online learning. One of the powerful impact channels for learning is online learning environments (OLEs) used by millions of learners and thousands of educational institutions worldwide. For learners to progress in learning, it is required to grow the mindset and skill set of an active way of learning. Learning in OLEs requires learners to be active and autonomous because of the lack of contact with advisors, teachers, or instructors. Such an active mindset and skill set for learners is named self-regulated learning (SRL).

This research aims to support learners' recognition of their SRL ability in OLEs. We think that adequate support can be done by assisting learners in seeing their online learning history and then helping them understand their learning patterns. To achieve this objective, we highlight two main subjects of this research: the method for modeling online learning behaviors and the framework for explaining the model. We pave the studies on these two subjects with the following research questions.

- RQ1: What intrinsic and extrinsic factors construct and differentiate the SRL ability of a learner?
- RQ2: How can these SRL factors be identified and measured from a learner's learning history?
- RQ3: Under what cognitive or metacognitive conditions are individuals intrinsically/extrinsically motivated to self-regulate their learning?
- RQ4: By what signs can learners' learning history data in OLEs manifest SRL patterns?
- RQ5: How can learning history data from OLEs be synthesized for assessing the SRL ability of a learner?

The research outcome will be twofold:

- An SRL Recognition and Improvement framework (SRL framework for short) which is a source of reference for recognizing the SRL characteristics of a learner and measuring SRL ability;
- A learner Markov model structure for modeling SRL characteristics of learners in OLEs.

The SRL framework contains sound principles for describing SRL ability. The Learn Markov Model refers to both the model of a self-regulated learner and the method to generate the model from online learning data.

To build the SRL framework, we dated back to the basic principle of the mind and then reviewed existing SRL models popular and widely used to analyze their common and unique attributes and root principles. The purpose of the SRL framework is to give a source of explanation for SRL related activities, SRL ability, and SRL modification for improvement.

The learner Markov model is an application built from a reference to the SRL framework to support learners' recognition of their SRL patterns in an online learning context. We demonstrated a procedure to generate resource use sequences from learners' learning history data, suggested how to present SRL activities visually, introduced the SRL profile – a description of learners' SRL characteristics - and especially proposed the quantitative measurement of SRL ability – the SRL index.

The proposed method was applied to an open dataset from the Open University, one of the world's largest universities of online learning, for evaluation. We built prediction models to predict learner performance and compare the prediction results with current approaches to demonstrate the potential of our method. We also discuss the combination of the SRL framework with the SRL profile to support the understanding of learners' SRL.

Since the SRL framework and the proposed method for learner Markov modeling are newly introduced, there are several limitations to the validation of the framework, the specific approaches for SRL improvement, and the application of learning Markov modeling on other learning history data besides OULAD needed to justify its generalization. Such limitations call for future works to test the proposed framework and modeling method on other cases.

With the SRL framework as fundamental and the method for modeling SRL profile, we believe that the outcomes of our research help to ease the understanding of SRL and make the recognition of SRL concrete and the improvement of SRL approachable.

Keywords: Self-regulated learning, SRL profile, SRL ability, Online learning, Learner model.