Chapter 15

The Role of Self-Regulated Learning in Enhancing Conceptual Understanding of Rate of Chemical Reactions

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ABSTRACT

The authors have investigated the effects of self-regulated learning (SRL) prompts on the academic performance of 30 year 9 students (12-13 year olds) learning science in a computer-based simulation environment by randomly assigning participants to either a SRL prompted or non-SRL prompted group. Mixed methods approaches were adopted for data collection and data analysis. Students in the SRL prompted group were given activity sheets which contained SRL prompts, whereas students in the non-SRL prompted group received no SRL-prompts in their activity sheets but some general prompts regarding how to follow the activity sheet. The incorporation of SRL prompted instructions into a computer-based simulation environment that teaches the rates of chemical reactions facilitated the shift in learners’ academic performance more than the non-SRL-prompted condition did. This shift was associated with the presence of the SRL behavioural prompts in the activity sheets. This study is a starting point in understanding the impact of the application of SRL-prompted instructions to the teaching of topics in a computer-based learning environment with a view to improving students’ academic attainment.

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Self-regulated learning (SRL) is an active and constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour as well as the contextual features of the learning environment (Zimmerman, 1989). SRL helps learners to choose what to learn, determine how long they want to learn, determine how to learn, access relevant instructional materials effectively, as well as assessing their level of comprehension of learning materials (Zimmerman, 1989). The three main phases of self-regulation, namely planning, monitoring and evaluation, are described as being consistent with the regulatory processes that students engage in during the process of learning (Manlove, Lazonder & De Jong, 2007). Planning is a very important strategy that students need to deploy when learning with computer-based simulation learning environments. It is not surprising, therefore, that recent studies in the field of science learning revealed that science learners are required to manage and evaluate their own efforts in order to attain the specified learning goals, when using technological resources, such as a simulation learning environment, for inquiry and problem-based learning (Manlove, Lazonder & De Jong, 2007). Manlove, Lazonder, & De Jong, (2007) used embedded static scaffolds to facilitate self-regulatory processes (e.g., planning, monitoring, and evaluating) during inquiry learning. They based their assumption that these would be effective on the hope that learners will make use of them during learning; they will know when to use them and thereby monitor their learning processes.

Other researchers, such as Azevedo, Cromley, Winters, Moos, & Greene, (2005); Demetriadis, Papadopoulos, Stamelos, & Fischer (2008) have examined the role of students’ ability in regulating their metacognitive activities when engaging with a computer learning environment. According to Zimmerman (2000), self-regulating students will set goals and sub-goals the first time they are introduced to the learning task which in turn help them to decide on specific outcomes of the learning or performance. Once self-regulating students begin to carry out their strategic plans, they begin to monitor their comprehension and task performance. Effective strategies for monitoring include self-questioning and elaboration which includes note taking (Demetriadis, Papadopoulos, Stamelos, & Fischer, 2008). Evaluation of learning processes involves reflection on the quality of the students’ planning or how well they execute their plans. Learners who self-regulate will try to evaluate their learning based on the goals they set for themselves at the beginning of the task which should include adequate prediction as well as very clear inferences. Furthermore, research has shown that the challenges that self-regulated learners encounter in a computer-based learning environment differ from those in the conventional classroom (Zimmerman 2000). This might be associated with the large amount of information available as well as the attractive but irrelevant materials such as pictures and animations contained in the computer-based learning environment. These challenges of overload and irrelevant information may result in learners’ inability to control and regulate their learning activities effectively (Narciss, Proske, & Koerndle, 2007). For instance, they often have badly constructed plans or they do not have plans at all. In situations where most students determine what to do as they move on with the learning, they make ad-hoc plans rather than taking a systematic approach. Zimmerman (2000) described this method of self-regulation as generally being ineffective because it fails to provide the necessary goal structure and strategic plans for students to progress consistently, monitor and evaluate their learning effectively.

In order to overcome these challenges, various instructional interventions that could help learners to regulate their cognitive and metacognitive activities are necessary when engaged with a simulation learning environment. Prompting students with SRL behaviours might help to over-
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