ABSTRACT

To make learners become self-regulated learners is a heart of education, because, after graduating from school or college, learners are expected to be able to learn many crucial skills informally for living their life by their own. To become self-regulated learners, learners must have motivation for maintaining their emotion to perform metacognitive skills to accomplish their tasks. However, learning or training metacognition is not a simple task due to the implicitness of metacognition and the complication of its training process. To avoid cognitive load and frustration which is a cause of demotivation in novices learners in training metacognition, there should be an implicit meta-level thinking skill which could be alike an assisting ladder to support them to step up to the stage of self-regulated learners. I would name that implicit skill as *Seed skill to become a self-regulated learner* (S2SRL). That is, S2SRL here refers to a skill in which learners are curious on their own understanding and awareness of self-improvement in their learning before learners can perform metacognitive questions by themselves to reflect their own cognition for planning, monitoring, and doing self-evaluation.

The goal of training metacognitive skills is to help learners to be comfortable with applying meta-level thinking on their cognitive process and become self-regulated learners who can automatically monitor and regulate their learning processes and be aware of their difficulties to achieve their tasks. However, it is also a difficult task for novices to think about metacognitive questions by themselves. Therefore, in this dissertation, before encouraging novice learners to use metacognitive skills, I proposed to provide them some examples of metacognitive questionings and examples of a situation to use those metacognitive questions to engage and encourage them to gain S2SRL. To promote metacognitive questionings corresponding to learners' learning process by using an adaptive method, computer technology is considered.

Moreover, to encourage learners to be curious on their own understanding and awareness of self-improvement in their learning or to gain S2SRL, it is necessary to motivate and facilitate them to have clear process of a given task in their mind. Later, they can use those in their mind as their cognitive target to perform meta-level thinking. From my past experience and evidence in standards test (e.g., PISA, TIMSS), most students have difficulties in solving MWP, due to they rarely take the time to monitor and regulate the use of cognitive strategies. This shows that solving MWP having a room to applied metacognitive skills. This is considered as an advantageous feature of MWP which could be employed as a medium to train metacognition.

To achieve my desire to design an environment for encouraging learners to use intrinsic comprehension of metacognitive questioning to acquire S2SRL in MWP learning, instead of just proposing a specific environment, there is more impact to create a framework for designing a required environment. Thus, CREMA has been developed to be a framework for designing an environment to encouraging learners to use intrinsic comprehension of metacognitive questioning to acquire S2SRL in MWP learning. This raised the research problems that "can the proposed framework really support learner to gain S2SRL?" And "how does it work in a practical environment?" In order to answer the research questions, the investigation to evaluate the effectiveness of and investigate the implementation of CREMA was performed by comparing three classes of low-performance students of grade-9 were assigned into three different learning groups: (i) a group of students who learnt MWP with our proposed method by implementing CREMA, (ii) a group of students who learnt MWP in traditional method combining MetaQ MetaQ—metacognitive questions and motivative statements, and (iii) a group of students who learnt MWP in traditional method.

The result from our investigation showed that MetaQ played an important role in CREMA while integrating computer and technology enhanced students' learning sense and empowered methodology to facilitate learning objects in the implementation of CREMA to effectively support students to gain S2SRL in MWP learning.

Keywords: Mathematical word problem; metacognition; metacognitive questioning; motivation; seed skills to become a self-regulated learner; self-regulated learners.