Infusion of Metacognition among Form Four Students for Problem Solving in Stoichiometry

ABSTRACT
This study explored the ability of high, medium and low achieving students in solving Stoichiometry problems from the aspect of metacognitive knowledge, metacognitive regulation and the level of understanding of the macroscopic, microscopic and symbolic representations after the infusion of metacognitive skills.

Nine Form Four students aged sixteen from a secondary school were involved in the study. Data were collected from students’ think-aloud sessions, interviews, and students’ class work. Results from the study showed that high achieving students have high metacognitive knowledge from the aspects of declarative and procedural knowledge while low in conditional knowledge. Medium achieving students showed a somewhat high declarative and procedural knowledge but low conditional knowledge. Low achieving students showed moderate declarative and procedural knowledge and low conditional knowledge.

For metacognitive regulation, high achieving students indicated planning and analysis at a high level in solving the Stoichiometry problems. Medium achieving students showed planning and analysis at an average level. The majority of the low achieving showed planning only for simple questions and these students were unable to solve difficult Stoichiometry problems involving balanced chemical equations. High, medium and low achieving students did not indicate monitoring or evaluation.

The high achieving students could understand and solve all the Stoichiometry problems related to balancing chemical equations from the macroscopic, microscopic and symbolic aspects at the end of the infusion. The moderate achieving students could solve the problems and understand the three levels of representation, but some cannot understand the mole ratio in balancing chemical equations. The low achieving students can understand simple Stoichiometry problems. However, they cannot understand the
mole ratio in balancing chemical equations. Therefore, they are unable to solve Stoichiometry problems involving balancing equations. In terms of transfer of knowledge, metacognition from Stoichiometry problems to limiting reagent problems, high, medium and low achievement students show transfer of declarative knowledge and procedural knowledge, but do not for conditional knowledge. While in terms of metacognitive regulation high, medium and low achievement students show transfer of planning, and analysis in limiting reagent problems, but do not show monitoring, evaluation activities. Implication of the study and suggestion for further study was also discussed.