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Developing Thinking Skills Through Problem Solving

Lucille Lee Kam Wah, Coh Ngoh Khang and Chia Lian Sai

The project "Developing Thinking Skills Through Problem Solving", was an extension of the previous project entitled, "Problem solving variables and the assessment of problem solving ability and skills in Electrochemistry" to an action research project that involves a teacher-researcher teaching linkage and problem translation skills in actual classrooms and investigates its effectiveness in improving students' problem-solving performance and skills. The topic chosen for this study is Mole Concept at O-level.

Objectives

The objectives of this project were to

- i Reconfirm some of the cognitive variables that have been found to be important predictors of problem solving performance in the earlier studies are also important to another topic at a different level (the earlier studies worked on the topic of Electrochemistry at A-level),
- ii Develop a particular teaching strategy for the topic of the Mole Concept to train students in some **problem-solving skills**, namely, linkage and problem translating skill, in addition to teaching students the content knowledge of the topic, and
- iii Investigate the feasibility of explicitly teaching the students the problem-solving skills and the effects of this teaching on the students' problem-solving performance and acquisition of these skills.

Sample and methodology

One hundred and fifteen secondary three pure chemistry students from three classes in the same school were involved in this study. All the students were in the express stream with an average age of fifteen years. Five instruments were designed and administered as pretests to the students before teaching the topic of Mole Concept. All students underwent seven weeks of instruction, with two out of the three classes of students being taught linkage and problem translating skills explicitly, while the remaining class was not. The two classes with the same treatment were analyzed as separate groups so as to provide further confirmation of the treatment effects. Thereafter, the same five instruments were administered to the students as post-tests.

Results and implications

The overall results show that four of the five cognitive variables, *Concept Relatedness (CR)*, *Idea Association (IA)*, *Specific Knowledge (SK)* and *Problem Translating Skill (PTS)* investigated are important determinants of problem solving success. The fifth cognitive variable, *Non-Specific but Relevant Knowledge (NSRK)*, although is not significant statistically, is important conceptually. Altogether, the five-predictor variables accounted for 48% of the variance in the problem-solving performance of the students. The study also suggests that the difference in the topics and levels appeared to have little effect on the importance of these variables on problem solving performance. The results also show that the explicit teaching of linkage and problem translating skill does enhance students' problem-solving performance and their linkage and problem translating skills. In addition, the teaching of these skills is feasible and practicable in the classroom environment.

The results of this study confirm the findings of our earlier studies that an effective problem solver requires the following problem-solving ability and skills:

- ❖ A good understanding of and meaningfully learnt knowledge;
- ❖ Appropriate problem-solving procedures which include the re-description of the original problem in a way facilitating the subsequent search for its solution;
- ❖ Relevant linkages of information between the information of problem statements and the existing cognitive structure

Teachers should emphasise the above three aspects to improve students' problem-solving performance in Chemistry.

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