

ABSTRACT

THE ROLE OF COGNITIVE STRATEGIC QUESTIONING IN THE CHANGES OF STUDENT'S CONCEPTIONS ABOUT HEAT AND TEMPERATURE

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One of the difficulties in the changes of students' physical conceptions is that learners can not make their status explicit and therefore can not accept feedback from themselves or others. Although questioning in the educational situation has been thought as important since Socrates, student's questioning for learning was less investigated than teacher's questioning for teaching.

This paper analyzed the role of student's cognitive strategic questioning developed for making comprehension status explicit or making conceptual status explicit in the changes of conceptions about heat and temperature.

One hundred and fifty two students of the 11th grade were sampled and divided into three groups, respectively, one control group with the traditional instruction, one experimental group I with students making comprehension status explicit, and one experimental group II with students making conceptual status explicit. Students'

conceptions about heat and temperature were investigated before and after instruction. In order to encourage student's cognitive strategic questioning, counter intuitive situations were developed and work sheets for student to record cognitive strategic questioning with paper and pencil were provided for students.

Results of students' conceptual changes analysed by ANOVA showed that there were significant differences ($p < .05$) among three groups and between pre- and post-instruction. There were significant differences ($p < .01$) between experimental and control group. Frequencies of student's cognitive strategic questionings were correlated with conceptual changes, with a coefficient of 0.738 for experimental group I and 0.914 for experimental group II. Although frequencies of high level questionings were less than those of low level questionings, they were highly correlated with conceptual changes, respectively, with a coefficient of 0.966 for experimental group I and 0.971 for experimental group II.

In conclusion, instructions of this research to encourage student's cognitive strategic questioning with paper and pencil were more effective to change students' conceptions about heat and temperature than the traditional one. And high level cognitive strategic questionings played important role in conceptual changes. Furthermore it is necessary to study the instructions to investigate the effects of student's oral questioning.

key words :heat and temperature, conceptual change, cognitive strategic questioning, counter intuitive situation, making comprehension status explicit, making conceptual status explicit.