Abstract

Previous studies found that beginning and experienced students had great difficulty acquiring concepts of motion and mechanical function. The mental model approach and the common sense model provided competitive explanations for the difficulty and recommendations of how science instruction can intervene.

This study intended to examine the controversy about science instruction between these two approaches. A "more analogical instructional program" based on the mental model approach and a "more quantitative instructional program" based on the common sense model were designed. Students' prior knowledge of physics and task complexity were introduced in the analysis of adaptability for the two treatments.

The quantitative instructional program emphasized on mathematical reasoning and presented teaching material via a less elaborate media attribute (static pictures). While, the analogical instructional program taught visual reasoning and presented material via a more elaborate media attribute (simulation). These two treatments followed the same instructional strategies suggested by Clark (1990). A simple machine, pulley, has been chosen as the learning task.

One hundred and thirteen subjects were randomly selected from Tamkang University in Taiwan. Their problem solving performance was the dependent variable.

The results confirmed findings of the common sense model which acknowledge the limitation of simulation. The presumed levels of task complexity were also confirmed. Subjects though had learned pulley in high school performed poorly in the most complex tasks of pretest.

Analyses showed that after instruction students in both treatment groups achieved equally well at every task level (simple, complex, and most complex). For both groups, performances in the simple and complex levels were about the same which in turn were

significantly better than the performance in the most complex level. Such findings go against the arguments of proponents of the mental model approach.

In the learning of the most complex task, subjects whose prior knowledge were higher benefited more from the quantitative treatment, while subjects whose prior knowledge were lower benefited more from the analogical treatment. This result suggests that in the selection of adaptive instruction science educators should take prior knowledge into consideration.