THE EFFECT OF SUPERFLUOUS INFORMATION ON CHILDREN'S SOLUTION OF STORY ARITHMETIC PROBLEMS

ABSTRACT. Forty 6- to 7-year-old children were tested with single-step, addition/subtraction story problems with and without superfluous numerical information. Half of the children were allowed to find out the solution using objects and half were given pen and paper. Fewer problems with superfluous information than those without such information were solved accurately. Less than half of the problems were attempted with spontaneous modelling with objects and rarely were pen and paper used. In many cases, the use of objects could not facilitate solution of problems with superfluous information thus suggesting that in these cases children's failure to solve the problems could not be explained just by an increase in the cognitive demand for selective attention to, and memory of, the relevant information.

INTRODUCTION

It may appear to be simple to solve a single-step, addition/subtraction story arithmetic problem such as “In the beginning, John had 9 coins. Then he gave 4 coins to Mary. How many coins does John have now?” While there has been research which shows that many young children could be quite competent in solving some story problems by employing various sensible and useful strategies, there are findings which show that even the slightest variation of the problems could affect children's performance (e.g. Carpenter and Moser, 1982; DeCorte and Verschaffel, 1987; Hiebert, 1982; Jerman 1973; Jerman and Rees, 1972; Riley et al., 1983).

One of the ways to vary the problems is to include information in the story content which is not necessary for the solution of the problems. Such superfluous information often results in more incorrect solutions (e.g. Goodstein et al., 1971, 1972; Blankenship and Lovitt, 1976; Zweng, 1979; Nesher, 1976; Cohen and Stover, 1981; Muth, 1984). However, it is not always clear from previous research why this is so. One possible reason is that superfluous information creates greater cognitive demand on children to selectively attend to, and remember, the relevant information. Another possibility is that when children are presented with such problems, they do not distinguish the superfluous sets from the relevant sets but simply manipulate the numbers according to verbal cues in the content which normally signal what arithmetic operations are involved (e.g. Sherrill, 1983).
If children fail to distinguish superfluous sets from relevant sets, we would expect them to incorporate superfluous numerical information into their solutions. To find out whether they do so, more information is needed on how they arrive at the solutions. Such information can be obtained by analysing the solutions and by asking children about their strategies and noting what they do while they attempt to solve a problem. Although some researchers (e.g. Carpenter, 1985) have analysed the strategies children use in their solution of story problems, such an analysis has not been applied to problems with superfluous information. The present study is thus an attempt to fill the gap.

If worse performance on story problems with superfluous numerical information is just a consequence of the greater demand on information processing, methods which can reduce the demand should be able to help children in solving these problems. One way of reducing such demand is to allow children to model the problems using actual objects. According to the theory of story problem solving proposed by Riley et al. (1983), one major developmental change is the increase in children's ability to represent problems mentally with the increase in age. Young children have greater difficulty in forming a mental representation of problems and so they would benefit from modelling of the problems with objects. Such facilitative effect has been confirmed in previous studies (e.g. Hiebert, 1982; Ibarra and Lindvall, 1982; Blume, 1981; Hebbler, 1977). Two different methods have been tried. In some studies, the experimenter used objects to illustrate the sets and the action whilst reading out the problems. In others, children were just given the objects and left to their own devices as to how to model the problems. The former method begs the question of what is actually being assessed. When both the sets and the action described in the problem (the changes, acts of combination etc.) are modelled with objects by the experimenter, children may arrive at the correct solution by simply counting the relevant set in the final state, without any understanding of the problem as a whole.

Whether children would spontaneously model problems with superfluous information and whether their modelling would facilitate problem solving have not been investigated by other researchers. The present study attempts to clarify this. In this study, some children were given objects for manipulation with no help from the experimenter as to how to model the problems. If it is easier for children to arrive at the correct solutions of problems with superfluous information when objects are provided, then their difficulty with these problems when objects are not provided is probably due to the greater demand to selectively attend to the relevant