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The Influence of Refutational Text on Children's Ideas about the Earth

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Introduction

The results of an empirical study which investigated the influence of three different refutational texts on children's understanding of the scientific model of the earth are presented. Previous studies have shown that young children have difficulties in understanding the scientific concept of the earth as a rotating sphere and that they create various 'misconceptions' or 'synthetic models' of the earth on the basis of their prior knowledge (Vosniadou & Brewer, 1992). It appears that children categorize the earth as a physical object and apply to it the presuppositions of physical objects (i.e. solidity, stability, up/down gravity, etc.), which constraint their understanding of the scientific model of the earth. Vosniadou & Skopeliti (2005) examined in detail this hypothesis and showed that indeed there is a shift in children's categorizations of the earth from a physical object to a solar object, and that this shift is related to children's understanding of the scientific model of the earth. In the present paper we investigate the instructional implications of these findings in a refutational text study.

Three types of refutational texts were constructed. The first dealt with the flatness presupposition, the second with the flatness and up/down gravity presuppositions, and the third added to the above the information that the earth is a solar object rather than a physical object. We hypothesized that the refutational text that included the information about the categorization of the earth would improve children's text comprehension more than the other two texts.

Method

Participants. Eighty-one children participated in our study. All of them were 3rd grade students from a middle-class school in Athens, Greece.

Materials. The materials used were (a) three different refutational texts which referred to the earth and (b) a questionnaire consisting of 10 open-ended questions. This questionnaire was used both as a pre-test and as a text comprehension post-test. The questions were divided in three groups, those that arose directly from the text, inferential questions, and completely new questions that were not mentioned at all in the text.

Procedure. Three classrooms of 3rd graders were randomly assigned to one of the three experimental conditions. The pre-test was administered first. Then the children were given one of the three refutational texts to read for about half hour. Then the experimenter read the text aloud to the children and responded to clarification questions.

Results

A mixed ANOVA [text type x pre-post test] showed a main effect for text type, in favor of the categorization refutational text, for all the questions which were common for the three texts [$F(2,78)=3,551$, $p<.05$] and especially for the inferential questions [$F(2,78)=4,834$, $p<.01$]. Though the second text produced more scientific responses than the first one in the post-test, the difference between the first and second texts was not statistically significant.

Discussion

The results of the present study agreed with previous evidence showing that the use of a refutational text can be an effective mean of promoting conceptual change in science (Diakidoy, Kendeou, & Ioannides, 2002; Guzzetti, Williams, Skeels, & Wu, 1997). The categorization refutational text was more effective than the other two refutational texts in improving children's comprehension both in the case of the direct questions and the inferential questions. This effect could be due to the fact that the categorization refutational text included more information than the other two texts, but agrees in general with previous studies showing that the shift from categorizing the earth as a physical object to categorizing it as a solar object may be a prerequisite for understanding the scientific model of the earth (Vosniadou & Skopeliti, 2005). It seems that when children conceptualize the earth as a solar object, they can apply to it the characteristics of the other solar objects. As a result, it is easier for them to picture the earth as a rotating sphere which does not have the characteristic of physical objects, like solidity, stability, and up/down gravity.

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