

The Development of Knowledge about the Earth and the Day/Night Cycle in Blind and Sighted Children

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Introduction

We present the results of a study that compared sighted and congenitally blind children's knowledge of the earth and the day/night cycle. Our interest is focused on how congenitally blind children understand scientific information about the earth and the day/night cycle and how we can improve the teaching of science in this population. In prior research, Vosniadou & Brewer (1992, 1994) found that young children construct initial representations of the physical world based on their everyday observational and cultural experience. These representations may then stand in the way of understanding scientific explanations of physical phenomena which often are counter-intuitive and require a major re-organisation of prior knowledge. We wanted to investigate whether blind children will go through a similar process in their understanding of scientific explanations in the domain of observational astronomy as sighted children do, or, whether their knowledge acquisition process will follow a different path, because of their lack of optical experiences.

Method

Twenty sighted and 20 congenitally blind children participated in this study. Half of the sighted and blind children attended 1st grade and the other half attended 3rd grade.

Procedure

The interviews took place in the school and all the children were asked questions concerning the shape of the earth and explanations of the day/night cycle, based on the original astronomy studies by Vosniadou & Brewer (1992, 1994). Most of the questions required verbal answers. The children were also provided with play-dough in order to construct models of earth and sun.

Results

Children's responses were categorized as scientifically correct (3), initial (flat earth model) (1), or alternative (presence of misconceptions) (2). A two way ANOVA grade (1st vs. 3rd grade) x group (blind vs. sighted) was conducted on these data. The analysis showed main effects for grade [$F(3,1)=.002$ $p<.01$] in favor of the 3rd graders (1st

grade mean score:14.9, 3rd grade mean score:18.7), and for group [$F(3,1)=.014$ $p<.01$] in favor of the sighted children (blind children mean score:15.4; sighted children mean score:18.2). The analysis also showed that the blind children constructed fewer scientific models of the earth and the day/night cycle than the sighted children and also fewer and less developed alternative models.

Discussion

The results of the present study support the hypothesis that congenitally blind children will have difficulties understanding the spherical shape of the earth, just as sighted children do. It appears that congenitally blind children develop some basic knowledge about the physical world based on the perceptual information received through audition and touch which seems to form an adequate basis for forming a naïve theory of physics. It appears that this initial physical knowledge stands in the way of understanding scientific information about the shape of the earth and the day/night cycle in blind children just as it does with sighted children. Thus, the results indicate that the presupposition of flatness and especially the belief that gravity works in an up/down way, operate both in the sighted and blind children. Despite the similarities in the two groups, there were also differences between the sighted and blind children. First, the sighted children were able to form more scientific models than the blind children, as shown by the statistically significant differences between them. In addition, it appears that the sighted children were able to form more complex synthetic models than the blind children, such as the hollow sphere, as well as mixed models. Blind children's responses were less informative and more stereotypical than the sighted children responses.

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