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Explicit versus tacit knowledge in early science: Young children's understanding of object speed and acceleration

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There is consensus among the existing literature that many students exhibit alternative conceptions as well as a resistance to conceptual change within science education, notably within the domain of physics. The current research aimed to investigate whether at an earlier age alternative knowledge that might facilitate conceptual change could be tapped into. In two computer-presented studies, 127 primary school children aged 4 to 11 years were assessed on their understanding of naturally induced object speed and acceleration along a horizontal, down an incline, and in free fall. Study 1 assessed the children's explicit conceptions of such motion using a tube and balls. Pictures of the set-up were presented on a computer screen, with descriptions of possible outcomes if motion were to take place, and the children were required to choose their prediction. The results show a high positive correlation with those from a previous task where the same tube-and-balls set-up had been used, but as a real object task. They further suggest that while the children's understanding generally does not comply with accepted scientific views there is conceptual change in explanations over age, indicating low resistance, if any, to change. Study 2 aimed to assess the same children's tacit understanding of object motion. They were shown short video clips of the same set-up used in Study 1, but with motion occurring, either correctly or incorrectly. During each trial the children were asked to make a decision as fast as possible – whether what they saw in the clips looked correct or incorrect. The results are contrasted to those of Study 1, indicating a mismatch between a task requiring explicit understanding and a task relying on tacit knowledge. These findings in particular merit subsequent investigation, and it is hoped that the overall findings may contribute towards facilitating conceptual change within early science education by making use of tacit knowledge.