

Teachers' Beliefs about the Role of Interaction in Teaching Newtonian Mechanics and Its Influence on Students' Conceptual Understanding of Newton's Third Law

JOHANNA JAUHIAINEN¹ (johanna.jauhiainen@helsinki.fi), ISMO T. KOPONEN² (ismo.koponen@helsinki.fi) and JARI LAVONEN¹ (jari.lavonen@helsinki.fi)
1 Department of Applied Sciences of Education, University of Helsinki
2 Department of Physical Sciences, University of Helsinki

ABSTRACT Students' conceptual understanding of Newton's third law has been the subject of numerous studies. These studies have often pointed out the importance of addressing the concept of interaction in teaching Newtonian mechanics. In this study, teachers were interviewed in order to examine how they understand interaction and use it in their instruction. The results show that teachers have a wide variety of beliefs about interaction. Moreover, by using the Force Concept Inventory test the understanding of Newton's third law by the teachers' students was tested. According to the results, the explicit use of interaction as a guiding principle in mechanics instruction helps students understand Newton's third law.

KEY WORDS: Dominance principle, Newtonian mechanics, students' conceptions, teachers' beliefs

Introduction

Numerous studies (e.g., Maloney, 1984; Terry & Jones, 1986; Brown, 1989) demonstrated that based on intuition and years of experience with moving bodies, students tend to think of force as a property of an object and consider a situation with two bodies asymmetrically. That is, in an interaction, if the masses of the bodies differ, students often expect that the greater or the more active one exerts a greater force on the other. Halloun and Hestenes (1985b) refer to this conception as the *dominance principle*. These conceptions of force are deeply rooted, everyday experiences give support to them, and often instruction fails to produce change in them (see, for example the references in McDermott & Redish, 1999). Because of this, students face difficulties in understanding the basic concepts of mechanics and Newton's laws of motion, such as Newton's third law.

The concept of interaction, although not always explicitly expressed in the original works of Newton and in its subsequent interpretations, was nevertheless a central theme in the development of Newtonian mechanics (see e.g., Jammer,

