Research Study Profile Sheet

Title: **Peer instruction: a case study for an introductory magnetism course**
Authors: **J. Lenaerts, W. Wieme, and E. Van Zele**
Journal: **European Journal of Physics**
Date: **2003**

Summary/ Abstract:

Peer instruction (PI) has been introduced as a collaborative learning strategy for the introductory physics course for engineering students at Ghent University and in this paper results for the magnetism part are reported. Using the magnetism concept inventory, a test instrument comparable to the better known force concept inventory, the positive impact of PI has been demonstrated by comparing two similar student populations and measuring the Hake gain factor. Special attention has been paid to the enhancement of the traditional lecture demonstrations by PI and a number of worked out examples are given. The framework of Vygotsky's zone of proximal development is offered as a pedagogical explanation for the effectiveness of PI.

Research Design/Methods:

Recently a unique opportunity for testing the efficiency of PI presented itself at Ghent University. Due to a curriculum change in the Faculty of Engineering, an identical course of magnetism had to be taught to two very similar student populations: approximately 200 second semester engineering students (group I) and 200 third semester engineering students (group II). Both populations had an identical physics background and similar mathematical skills. While there were two different lecturers, both used the same course text, the same overhead transparencies and the same demonstration materials. Both had been teaching this course for several years in the traditional way. The physics department decided to continue traditional teaching for group I but to introduce PI for group II and to compare the performance of both groups using a pre-test and post-test based on the Magnetism Concept Inventory (MCI). Due to Faculty of Engineering regulations, participation in this test could not be made compulsory and in the end 150 students from group I took both the pre-test and post-test part, as well as 130 from group II.

Analytical Methods:

To evaluate the impact of PI we used the 19-question MCI test as described in [6], adapted somewhat to reflect the high school curriculum of our students 4 . Both groups took the MCI as a pre-test at the start of the semester and as a post-test after instruction. The results are shown in table 1 as percentage scores. Following Hake we introduce the normalized gain factor g defined by g = (post – pre) / (100 – pre) where 'pre' and 'post' are the pre-test and post-test percentage scores. This 'Hake g-factor' is a significant measure for the efficiency of instruction because it blurs out the influence of the different starting levels of the students, as it is equivalent to the maximum possible gain students can achieve.

Results:

The results are summarized in table 1.

Table 1. Students' performance on the MCI.

	N (participating students)	Pre-test (%)	Post-test (%)	Hake *g*-factor
Group I	150	31	58	0.39
Group II	130	26	70	0.59
Physics majors	39	35	56	0.32

Group I, without the benefit of PI, showed an average g = 0.39 (± 0.08) while the PI group II showed a gain g = 0.59 (± 0.10). Using the FCI as a gauge, Hake reports an average gain for traditionally taught introductory mechanics courses of g = 0.23 while courses using various 'active engagement' instruction methods yield gains between 0.34 and 0.69, averaging g = 0.48. Consequently, for introductory mechanics, PI yields on average a gain improvement Δg = 0.25. For our magnetism course we obtain a similar improvement in the normalized gain of Δg = 0.20, which can be considered a clear success for PI.

The positive influence of PI is corroborated by the result obtained for physics majors, also included in table 1. Using a different textbook and with a different instructor but with traditional methodology, this reference group shows a normalized gain of g = 0.32, significantly below what can consistently be achieved with PI.