Mathematical understanding of grade 8 students

Jeeyi Kwak, Aiso Heinze
Department of Mathematics, Carl von Ossietzky University Oldenburg, Germany

We will report on a survey in four classes of 8th grade at a secondary modern school (German Realschule). Overall 106 pupils were asked to answer ten exercises which mainly dealt with school geometry. The survey aims to investigate the pupils' knowledge on five general mathematical concepts, which are not taught explicitly in mathematics classroom. We want to find out: (1) Are grade 8 students able to give definitions; (2) Are they able to identify equivalent descriptions of a simple geometrical object; (3) Do they have an understanding of a mathematical proof; (4) Do they know that in general the converse of a logical implication is not true; (5) Are they familiar with the concept "proof by a counterexample".

First results indicates the pupils understanding of a mathematical proof. We gave the students three "proofs" for the statement that the vertical angles are equal. We asked the students a) to select the "proof" which they would choose as own approach and b) to select the "proof(s)" which are correct. It turns out that more than 50% of the pupils preferred the proof with the empirical arguments as own approach but only 39% chose this approach as right answer. This result corresponds to those of Healy and Hoyles (1998). In contrast to the results of Healy and Hoyles in our study more students preferred empirical arguments. This difference seems to base on different age groups and different mathematical skills of the populations.

With respect to logical implication, we presented a daily life problem and a mathematical problem. Most of the pupils answered correctly to the problem of daily life: More than 65% stated that the converse of the implication "If it rains, then the street is wet." is not true. Around 45% of this correct answers were given by a counterexample. However, in the case of the converse of the mathematical implication "If a square is a rectangle, then the opposite lines are parallel.", only 10% offered a correct answer. These results show similar tendency as those of Douek (1999) and Duval (1991).

References:

Douek , N (1999) *Some Remarks about argumentation and mathematical proof and their educational implications.* Proceedings of the First Conference of the European Society for Research in Mathematics Education, Vol. I, 125-139

Duval, R (1991). *Structure du raisonnement déductif et apprentissage de la démonstration.* Educational Studies in Mathematics, 22, 233-261

Healy, L & Holyes, C. (1998). Technical Report on the Nationwide Survey : *Justifying and proving in school mathematics*. Institute of Education, University of London.