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Development of students' beliefs in mathematical understanding in relation to mathematics and its applications

The study investigates the development of relationships between epistemological beliefs and the perception of mathematics in the course of a year. The intervention consisted of three supplemental courses of 22 students of grade 12 and 13 in German high schools, two devoted to coding theory and cryptography, and one to the mathematical aspects of cosmology and particle physics.

During the first quarter of the school year, the students studied the mathematical foundations of the course topics. In each of the last three quarters, the students were offered a choice between several project topics, or could find a topic themselves. They worked on the topics alone or in pairs. At the end of each quarter, the students had to present their results.

At the end of the second and fourth quarter, the students were interviewed, following a semi-structured concept, for about 25 minutes. The first interviews showed that the students' opinions about mathematical understanding were related to their definition of mathematics and their choice of project topics. By dividing mathematical understanding into active and passive categories, it became obvious that the students who used abstract attributes defined mathematics as suitable for the usage of applications and chose an abstract topic for projects, and vice versa. As it became evident in the latter interviews, most students' understanding of mathematics changed when their definition of mathematics and their choice of topics were done both from an application and an abstract point of view during the third and fourth quarter of the year.

Keywords: mathematical understanding, definition of mathematics, beliefs