

From Equations to Structures: Linking Abstract Algebra and High-School Algebra for Secondary School Teachers

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Abstract : The high-school curriculum in algebra deals mainly with the solution of different types of equations. However, modern algebra has a completely different viewpoint and is concerned with algebraic structures and operations. A question then arises: What might be the relevance and contribution of an abstract algebra course for developing expertise and mathematical perspective in secondary school mathematics instruction? This is the focus of this paper. The course Algebra: From Equations to Structures is a carefully designed abstract algebra course for Israeli secondary school mathematics teachers. The course provides an introduction to algebraic structures and modern abstract algebra, and links abstract algebra to the high-school curriculum in algebra. It follows the historical attempts of mathematicians to solve polynomial equations of higher degrees, attempts which resulted in the development of group theory and field theory by Galois and Abel. In other words, algebraic structures grew out of a need to solve certain problems, and proved to be a much more fruitful way of viewing them. This theorems in both group theory and field theory. Along the historical 'journey', many other major results in algebra in the past 150 years are introduced, and recent directions that current research in algebra is taking are highlighted. This course is part of a unique master's program - the Rothschild-Weizmann Program - offered by the Weizmann Institute of Science, especially designed for practicing Israeli secondary school teachers. A major component of the program comprises mathematical studies tailored for the students at the program. The rationale and structure of the course Algebra: From Equations to Structures are described, and its relevance to teaching school algebra is examined by analyzing three kinds of data sources. The first are position papers written by the participating teachers regarding the relevance of advanced mathematics studies to expertise in classroom instruction. The second data source are didactic materials designed by the participating teachers in which they connected the mathematics learned in the mathematics courses to the school curriculum and teaching. The third data source are final projects carried out by the teachers based on material learned in the course.

Keywords : abstract algebra , linking abstract algebra and school mathematics, school algebra, secondary school mathematics, teacher professional development

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