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Quod erat demonstrandum: **understanding and explaining equations in physics teacher education.**

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Summary: In physics education, equations are commonly seen as calculation tools to solve problems or as concise descriptions of experimental regularities. In physical science, however, equations often play a much more important role associated with the formulation of theories to provide explanations for physical phenomena. In order to overcome this inconsistency, one crucial step is to improve physics teacher education. In this work, we describe the structure of a course that was given to physics teacher students at the end of their master's degree in two European universities. The course had two main goals: (1) To investigate the complex interplay between physics and mathematics from a historical and philosophical perspective and (2) To expand students' repertoire of explanations regarding possible ways to derive certain school-relevant equations. A qualitative analysis on a case study basis was conducted to investigate the learning outcomes of the course. Here, we focus on the comparative analysis of two students who had considerably different views of the math-physics interplay in the beginning of the course. Our general results point to important changes on some of the students' views on the role of mathematics in physics, an increase in the participants' awareness of the difficulties faced by learners to understand physics equations and a broadening in the students' repertoire to answer "Why?" questions formulated to equations. Based on this analysis, further implications for physics teacher education are derived.

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