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Beyond mathematical content knowledge: A mathematician's knowledge needed for teaching an inquiry-oriented differential equations course.

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Summary: In this research report we examine knowledge other than content knowledge needed by a mathematician in his first use of an inquiry-oriented curriculum for teaching an undergraduate course in differential equations. Collaboratively, the mathematician and two mathematics education researchers identified the challenges faced by the mathematician as he began to adopt reform-minded teaching practices. Our analysis reveals that responding to those challenges entailed formulating and addressing particular instructional goals, previously unfamiliar to the instructor. From a cognitive analytical perspective, we argue that the instructor's knowledge – or lack of knowledge – influenced his ability to set and accomplish his instructional goals as he planned for, reflected on, and enacted instruction. By studying the teaching practices of a professional mathematician, we identify forms of knowledge apart from mathematical content knowledge that are essential to reform-oriented teaching, and we highlight how knowledge acquired through more traditional instructional practices may fail to support research-based forms of student-centered teaching.

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