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### **Research-based Tools and Tips for Teaching Quantum Mechanics**

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Despite our best and most sincere efforts, there is an alarming disconnect between what we teach and what students learn and understand. Learning quantum mechanics is especially challenging, in part due to the abstract nature of the subject. We have been conducting investigations of the difficulties that students have in learning quantum mechanics. To help improve student understanding of quantum concepts, we are developing quantum interactive learning tutorials (QuILTs) as well as tools for peer-instruction. The goal of QuILTs and peer-instruction tools is to actively engage students in the learning process and to help them build links between the formalism and the conceptual aspects of quantum physics without compromising the technical content. They focus on helping students integrate qualitative and quantitative understanding, confront and resolve their misconceptions and difficulties, and discriminate between concepts that are often confused. In this talk, I will give examples from my research in physics education of how students' prior knowledge relevant for quantum mechanics can be assessed, and how learning tools can be designed to help students develop a robust knowledge structure and critical thinking skills.